R A RCE
PE12

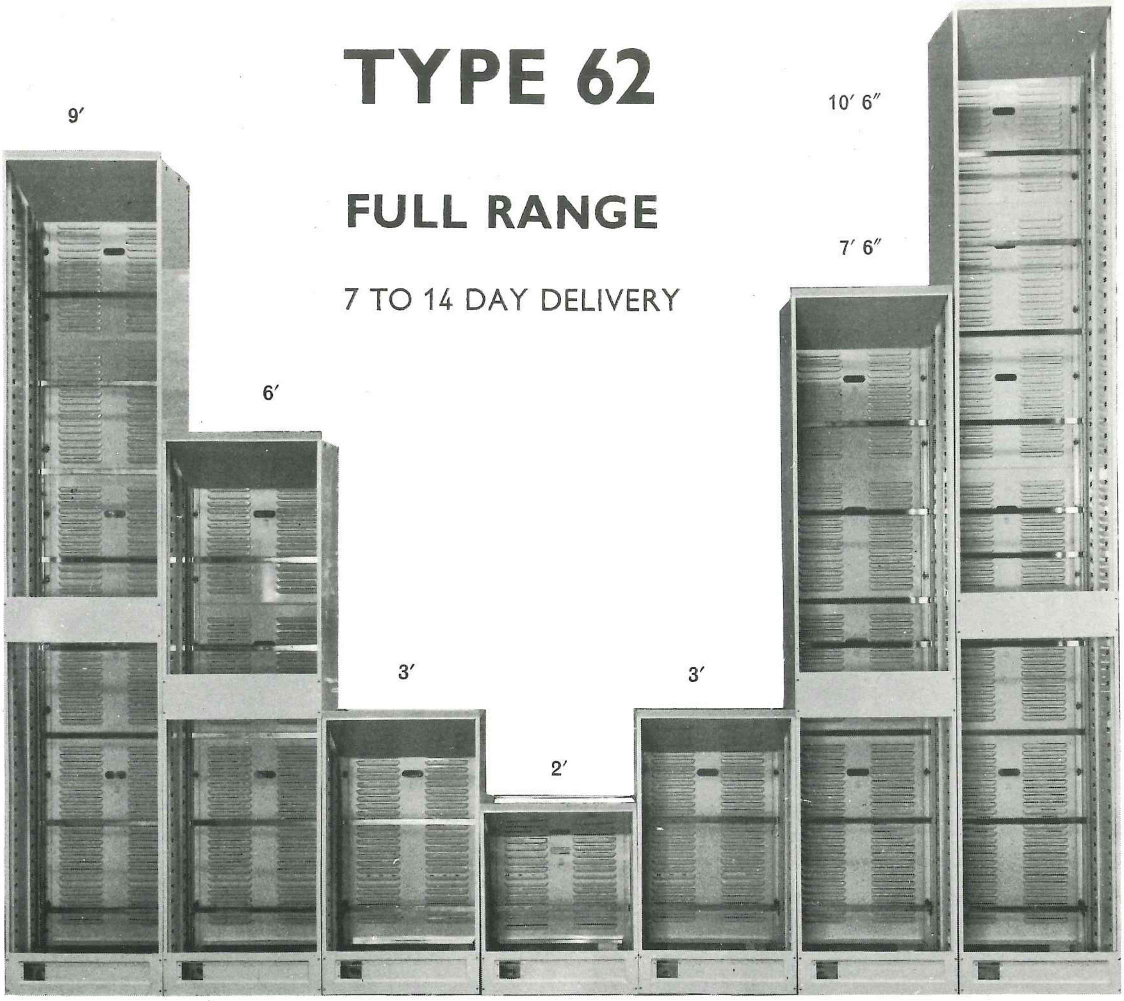
Post Office telecommunications journal

Summer 1974 Vol. 26 No. 2 Price 12p

TYPE 62

FULL RANGE

7 TO 14 DAY DELIVERY



HIGH PRECISION MECHANICS

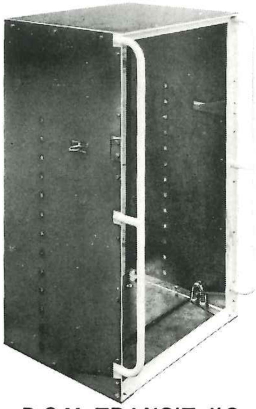
FOR INSTRUMENT ELECTRONIC AND AUTOMATION INDUSTRIES

TELECOMMUNICATIONS MECHANICS

P.O. APPROVED

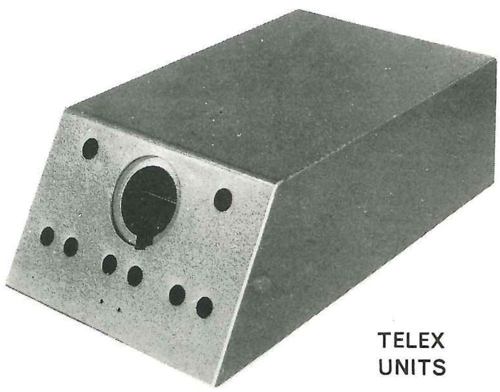
IMMEDIATE QUOTATIONS AND TECHNICAL SERVICE

SHELF ASSEMBLIES



P.C.M. TRANSIT JIG

DATEL MODEM



TELEX UNITS

CRAY ELECTRONICS LTD

THAMES ROAD, CRAYFORD, KENT
TELEPHONE: CRAYFORD 29251

Mullard components for Post Office electronics

Latest Micromins widen scope of Hybrid Design

Hybrid circuits with a higher performance and covering a wider range of applications are being made possible by the steadily growing Mullard range of microminiature semiconductor devices.

There are now thirty-eight types available including, not only general purpose devices, but FETs; v.h.f., u.h.f. and microwave transistors; double diodes; high speed switching diodes and zeners.

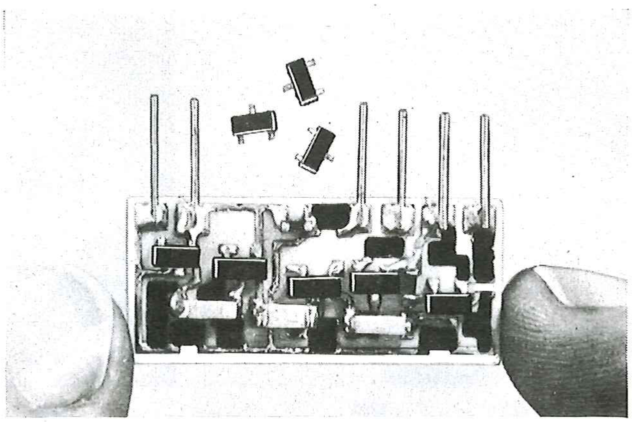
Each is a miniature version of a 'full size' item in the semiconductor catalogue. Ratings are impressively high, the upper limit generally being 200 to 300mW although each device in its plastic encapsulation is smaller than a grain of rice.

A recent addition to the range is a PUT (programmable unijunction transistor) type 555BRY. This is a microminiature counterpart of the BRY39/BRY56 and is a versatile p-n-p-n trigger device which can be used in motor control, oscillator, timer, pulse shaper and triggering circuits, as well as in place of a relay.

Another newcomer is the 565BAY Schottky barrier diode. Comparable with the full-size BA280, it is intended for use either as a u.h.f. mixer or as a fast switching device.

A third recent introduction is a variable capacitance diode, type 574BAY. This is a microminiature version of the BA182 which, in addition to its application in electronically tuned circuits, can be used as a T/R switch in small transmitting and receiving systems.

Full data on the whole range of Mullard microminiature semiconductor devices is available.

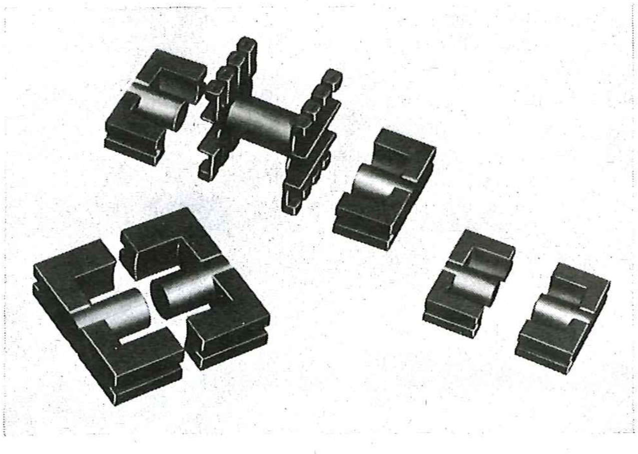


NEW CORES FOR SWITCHED MODE POWER

Designers of switched mode power supplies no longer have to use transformer cores of a material and shape which are meant for quite different applications. A new range of ferrite cores, the FX3700 series, being introduced by Mullard is intended specifically for the job. Insulation and safety, the special stresses of switched mode operation, winding economics, modes of circuit failure, mechanical specifications and BSI requirements have all been given extremely careful attention.

The new cores may be used in units where the input is derived from rectified mains or from batteries, and are suitable for designs covering a wide range of outputs. When used in 25kHz push-pull circuits at the unfavourable end of the application spectrum (supplying low voltage, 5V, output) d.c. output powers from 50W to 500W can be obtained. In more favourable applications, higher outputs can be obtained, and the cores can, of course, also be used in single-ended circuits.

Data is available on the four cores in the series together with an application note (ref. TP1450) which simplifies transformer design and can help save time, money and trouble elsewhere in the circuit.



BETTER COIL FORMERS . . . SAME PRICE

Coil formers for use with Mullard RM inductor and transformer cores are now being made with a high quality electrical grade of glass-loaded phenolic material. It can be readily distinguished from the earlier material by its dark green colour.

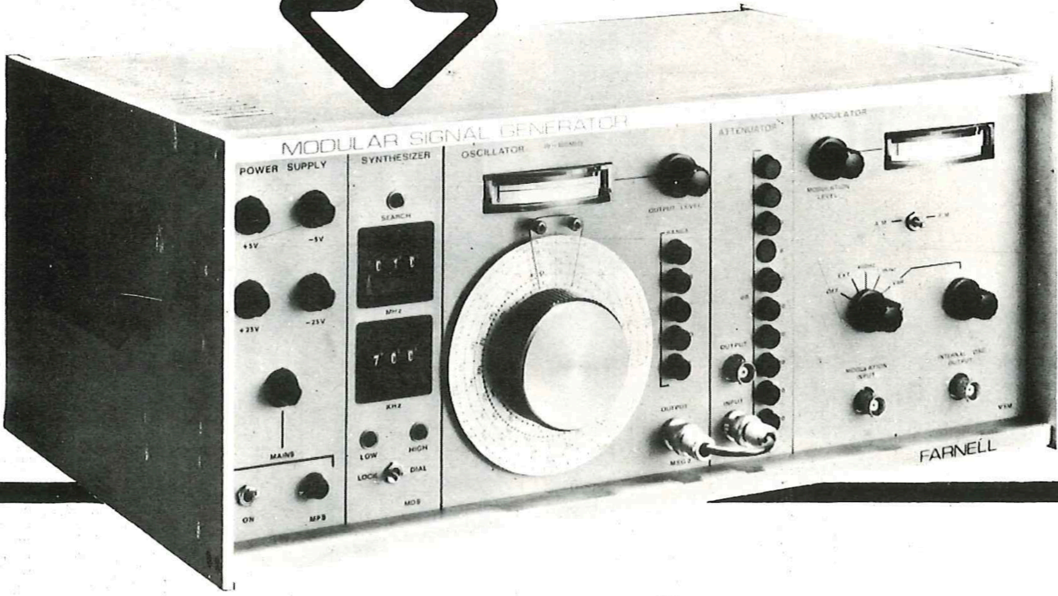
Formers made with the new material are interchangeable with their predecessors. Pin configuration, user dimensions and winding space are intended to conform with the IEC specification currently being prepared. As previously, the pins meet the solderability requirements of IEC68 and BS2011 (Part 2, Method 3). The improved material will not result in any price increase.

Mullard

For further information please contact your Mullard representative.

Mullard Limited, Mullard House, Torrington Place, London WC1E 7HD

Thanks to this new module . . .



. . . we can offer an accurate and drift-free phase-lock synthesized signal generator for around £800

The Farnell range of modular signal generators now includes synthesized models, M1/ADM and M2/ADM, to cover frequency ranges of 100kHz to 12MHz and 10MHz to 108MHz respectively.

Frequency is controlled by a six decade bank of thumbwheel switches to an accuracy of ± 5PPM. The oscillator automatically chooses the correct range and seeks the required frequency, a search lamp extinguishing when it has found it. And there the frequency will stay with crystal accuracy and stability until an alternative is selected. A 1kHz frequency change takes only milliseconds and a change as wide as 10MHz to 100MHz (which involves four range changes) is completed in about five seconds.

Like all Farnell r.f. signal generators and sweepers, there is facility for remote programming via TTL compatible BCD 1248 inputs through a rear connector.

Narrowband sweep application.
The M1/ADM is an excellent narrowband sweeper ideal for setting up receiver filters or discriminator circuits on an individual or production line basis.

Centre frequency is controlled with crystal accuracy and stability by the digital synthesizer module while the frequency modulator unit is used to provide sweep. Full a.m./f.m. modulation facilities are available after alignment tests.

For details of all Farnell r.f. test equipment contact:-

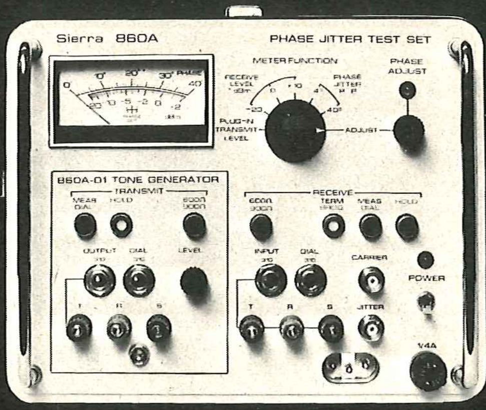
FARNELL INSTRUMENTS LIMITED,
TELECOMMUNICATIONS DIVISION,
SANDBECK WAY, WETHERBY,
LS22 4DH. YORKSHIRE.
TEL: 0937 3541, TELEX 557294
LONDON OFFICE TEL: 01-802 5359

Farnell


New
High quality
programming
switch
from AB
The slide action of our new 206 DIL component makes it less liable than other kinds to accidental de-programming.
It's flexible (from four to ten sections at a 2·54 mm pitch), it has contact wiping on make-or-break and gold-plated contact arms for long-term corrosion resistance.
High quality, sensible price, AB back-up. You should find out more.
ab
A.B. Controls
(A Division of A.B. Electronic Components Ltd.)
Abercynon Glamorgan CF45 4SF Gt. Britain
Tel: Abercynon (044-374) 331 Telex: 49606 Cables: Abec, Abercynon, Telex

ON TOP OF THE WORLD
GEC ACROSS THE BOLIVIAN HIGH ANDES

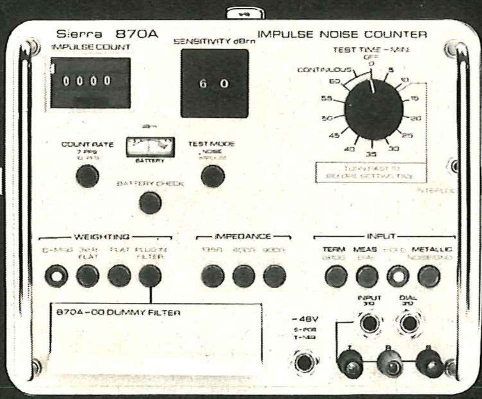
NEW DATA TRANSMISSION TEST SETS.



SIERRA 860A PHASE JITTER TEST SET

SIERRA 860A FOR JITTER

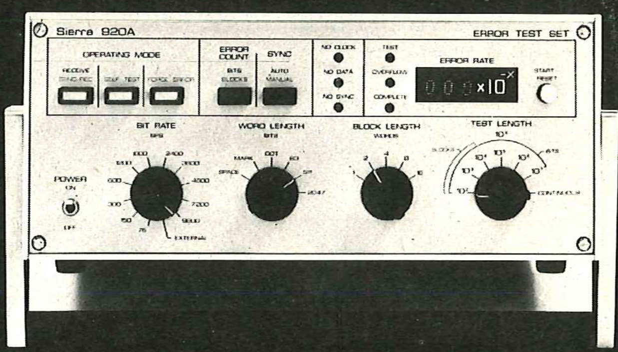
Set the range, tweak the meter. That's all you do to get a fast reading of peak-to-peak phase jitter and tone level. This 8 pound portable also offers dial-and-hold functions and a 1020 Hz plug-in tone generator. The set's designed to meet Bell System standards.



↞870A & 860A USED TOGETHER WILL MEASURE PHASE HITS↟

SIERRA 870A IMPULSE NOISE COUNTER

For voice band or wideband data channels . . . a 14 pound battery operated test set that measures noise spikes or levels (metallic or noise-to-ground) with sensitivity of 20 to 99dBrn. Time intervals settable from 9-60 minutes or continuous. Built-in C-message and 3kHz flat filters; optional plug-in weighting filters are available.

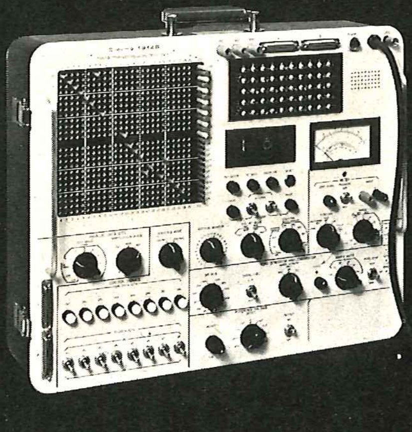


SIERRA 920A ERROR TEST SET

SIERRA 920A FOR ERRORS

Measure bit or block error rates in simplex, half duplex and full duplex modes up to 2 megabits per second. EIA compatible; may be customized for non-EIA modems. Bright LED digital error rate readout. Self test capability.

. . . BROUGHT TO YOU BY THE MAKERS OF THE FIELD-PROVEN 1914 SERIES . . .



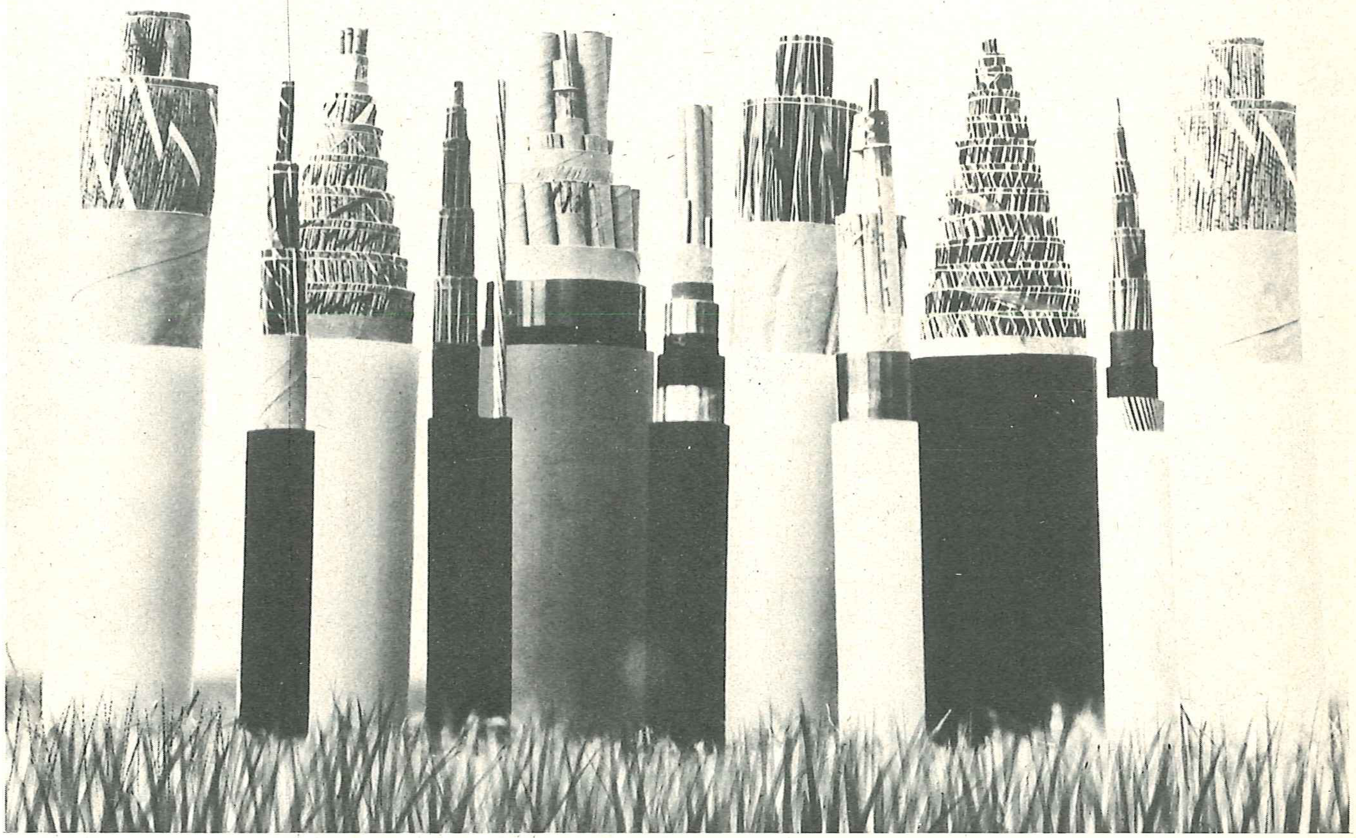
SIERRA 1914 FOR END-TO-END AND LOOP-AROUND DATA TRANSMISSION TEST.

Test asynchronous and synchronous voice band modems, check and display bit and block errors. Determine error rate margin. Check control signals and associated time delays. Perform in-service tests on modems. Do all this and much more, easily and simply with the lab-featured portable.

Write or call for the full story and a demonstration.

Sierra
Sierra Electronic Operation
3885 Bohannon Drive
Menlo Park, CA 94025
(415) 322-7222/TWX 910-373-1282
PHILCO Ford

U.K. Distributor :-
TONY CHAPMAN ELECTRONICS LTD 3 Cecil Court London Rd Enfield Middlesex Telephone 01-363 6688



Forecasts of development and change

The world is now served by more than 300 million telephones. A vast network makes possible communications on a world-wide scale. Yet demands for services continue to increase, with the result that the global telecommunications system is growing at a rate of seven per cent each year. In the United Kingdom alone nearly 20 million telephones make 15,000 million calls, which means that the world's total telephone traffic could be of the order of two billion calls per annum by the year 2000.

This rapid growth, together with demands for new and more advanced services, is occupying the energies of all telecommunications organisations. Recently stated Post Office views on the future of telecommunications forecast the development of a wide range of services, and point to the need for a radical change in the manufacturing techniques of Britain's telecommunications industry.

Mr Edward Fennessy, Managing Director of Post Office Telecommunications, predicted that by the year 2000 viewphones would be commonplace. Wideband circuits would by then be available to many homes, capable of delivering the daily newspaper by means of telecommunications. The same circuits would permit access to a wide range of programmes and library material for television purposes. Radiopaging would enable anyone equipped with a miniature receiver to be located at will over a wide territorial area, and a great international network of data circuits would link business organisations.

The most significant development, Mr Fennessy forecast, would be the ability of telecommunications to provide global face-to-face meetings of groups of people as a major alternative to personal transport. Already Britain's Confravision service has been extended into Europe on trial.

There are now no technical barriers to the introduction of world-wide services such as Confravision. The only inhibiting factor is the cost of providing the very wide channels needed to carry the television-type picture, but already developments are significantly reducing the basic cost of long-distance communication.

The need for a dramatic change over the next few years in the basic character of Britain's telecommunications industry – 70 per cent of whose output goes to the Post Office – was expressed by Mr Kenneth Cadbury, Senior Director of Purchasing and Planning. Different manufacturing techniques are required as a result of the Post Office's decision to eliminate strowger electromechanical equipment by the 1990s.

Instead of purchasing and processing raw materials like steel, copper, textiles and plastics to construct electromechanical exchanges, the emphasis will shift to the assembly of bought-in components. The purchasing organisations of the Post Office's main contractors and their suppliers will play an increasingly important role in helping to meet these needs.

Post Office telecommunications journal

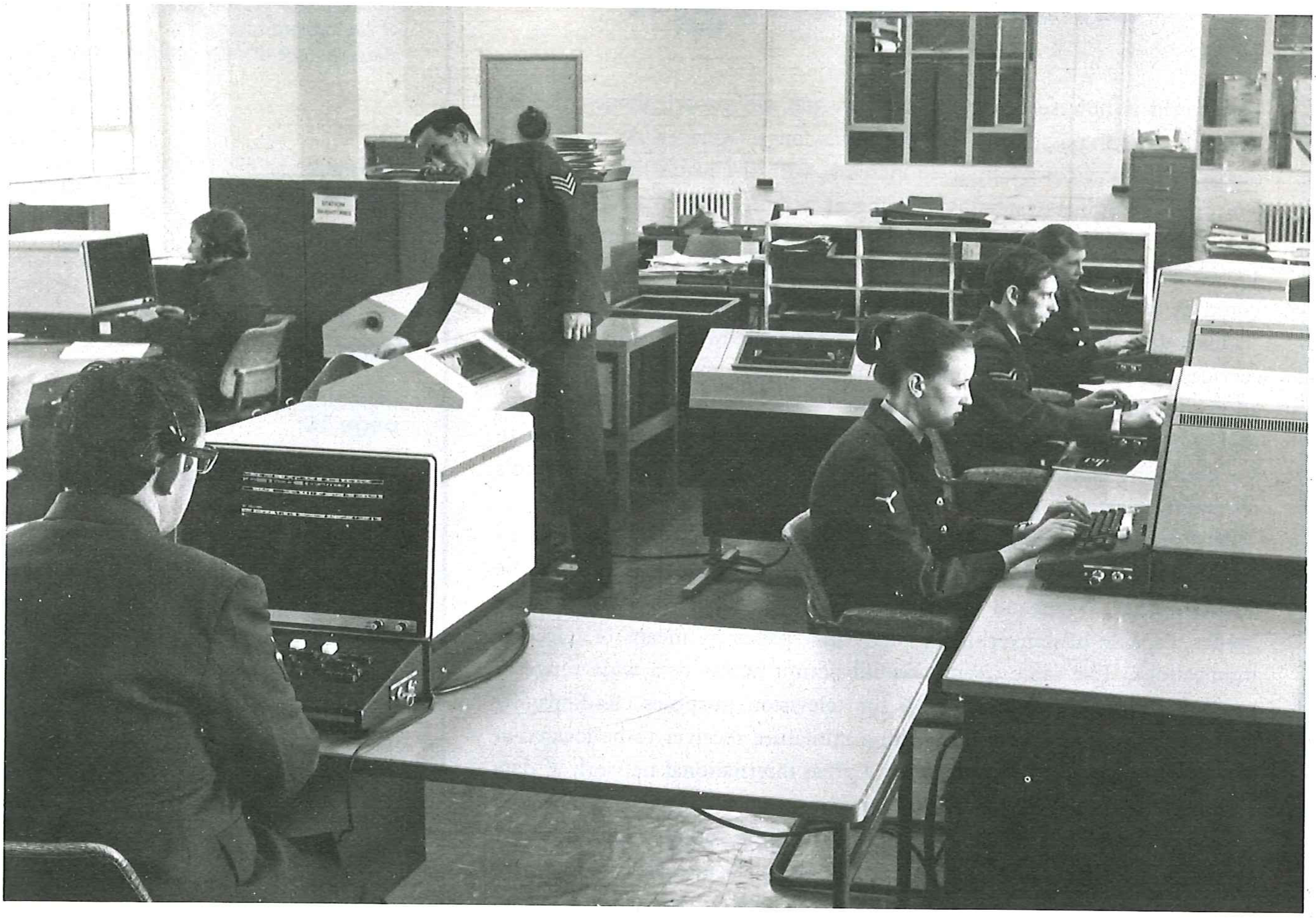
Summer 1974 Vol. 26 No. 2

Published by the Post Office of the United Kingdom to promote and extend knowledge of the operation and management of telecommunications

Cover: Post Office staff use specially-equipped vehicles to investigate complaints by the public of interference to authorised TV and radio broadcasts. The vehicle shown is the prototype for a new, improved fleet. (See page 20.)

RAF supplies system gets off the ground

PE Carter



Using terminals linked to a distant central computer, operators at RAF Brize Norton key in requests to obtain immediate information on the availability of stores and equipment.

ONE OF THE largest computer systems in the United Kingdom for the central control of supplies has been established for the Royal Air Force, with Post Office help. The system enables RAF Station Commanders throughout the UK and Western Germany to obtain immediate information from a single source on the availability and location of stores and equipment, ranging from WRAF shoes to jump-jets.

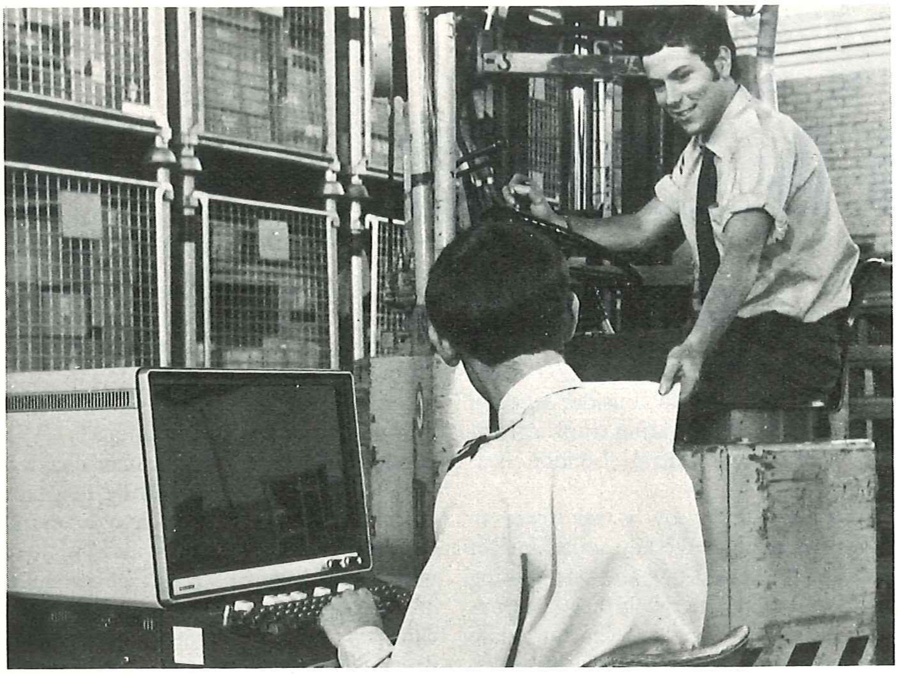
All information about stocks is held and updated by computer at the Supply Control Centre of the Ministry of Defence (Air). The Post Office has installed a nationwide private communications network in this country to provide high-speed links between the Supply Control Centre (SCC) and RAF stations and MOD establishments at more than 100 different locations in the UK and Germany. To provide service for the locations in Germany, Post Office circuits link the SCC with UK military radio stations. From these "gateway" stations the links are by military radio channels and, for certain more distant RAF stations, by channels provided by the Deutsches Bundespost.

Operators at the RAF stations and MOD establishments gain access to the central computer installation by means of terminal equipment which consists basically of a visual display unit (VDU) with a typewriter-like keyboard and an associated printer.

More than 1,000 remote terminals are currently linked to the system. By keying in a supplies request on his terminal, an operator can receive a reply within five seconds on the VDU. The computer system operates continuously, 24 hours a day, and can deal with 50,000 inputs daily at a peak rate of six per second.

The computer installation at the SCC was provided by International Computers Ltd, and is based on twin ICL 4-72 processors. Its operating system was developed by the Post Office National Data Processing Service (NDPS) and took 10 man-years of effort. NDPS prepared the computer programs by using the techniques it evolved for controlling the London Airport Cargo EDP Scheme (LACES), which provides HM Customs and Excise, airlines and agents with a service for clearing freight.

The computer system for RAF supply control was planned as the result of



The computer-based system enables prompt action to be taken at this RAF station supplies depot to meet a stores request.

studies carried out by the MOD in 1969 with the aim of replacing a system which had been set up in the mid-1960s. Based on three small computers, the earlier off-line system handles stores transactions from RAF stations over a private telegraph network, which is slow by today's standards. The new system is based on the Post Office Datel 2400 service which offers transmission between the terminals and central computer at 2,400 binary digits per second (bit/s). It also enables large-scale integration of supplies control and immediate response to terminals, which were not hitherto possible.

In October last year the first transaction was keyed into the replacement system from a terminal at RAF Station Brize Norton in Oxfordshire. Subsequent commissioning of all remaining terminals, using training traffic to the computer centre, was completed by the beginning of 1974, and it is planned that transfer of work from the earlier system will be completed by the end of the year.

The communications network provided for the new system by the Post Office comprises 50 circuits. Basically, point-to-point circuits are used between the SCC and military radio stations for the links to Germany, while terminals in this country are served by multipoint circuits. A multipoint circuit allows a main communication highway to be shared by a number of terminals, which are connected to it by means of spur circuits. Sharing is on a time division basis and is achieved by programming the computer to poll each terminal in a continuous sequence. This arrangement presents a saving in line plant for the Post Office and offers the customer a saving in rental costs compared with providing point-to-point circuits.

The main highway of a multipoint circuit is provided between the nearest Post Office Trunk Maintenance Control Centre (TMCC) to the computer centre and a TMCC convenient to the distant terminal locations. At the distant TMCC, branching equipment connects the main highway to the spur circuits serving the terminals.

Routing the main highway of the circuit in this manner gives a degree of safeguard against failure. Between the TMCCs a reserve circuit is provided by the Post Office so that service may be rapidly restored if the main line fails.

Multipoint circuits for the RAF system have been designed for a maximum of six spurs, with an average overall of three spurs per multipoint. Each circuit has been planned and provided to ensure a fair spread of terminals in relation to their geographical locations. By this means failure of any one main link will not isolate completely an RAF operational area or function from the computer centre.

An additional safeguard is provided by the ability to operate Datel 2400 over the public switched telephone network (PSTN). This facility is made possible by the Post Office modulator/demodulator units (modems) at each end of the multipoint circuits which enable data to be transmitted at 2,400 bit/s between the terminals and the central computer. In the event of interruption to service over a multipoint circuit, the terminal user or computer centre can establish contact by telephone over the PSTN, and by substituting the modem for the telephone can then transfer data at a speed of 600 or 1,200 bit/s.

The whole communications network was planned, and the specifications for it prepared, by the Network Planning Department at Post Office Telecommunications Headquarters. Installation of Post Office equipment at the computer centre and commissioning of the Datel circuits was carried out by staff of the North West Telephone Area and involved some four man-years of effort.

Oversight of the communications network is maintained at the computer centre by a key operator position, called the remote configuration controller (RCC). This position is constantly manned by RAF personnel, and RAF stations are required to contact the RCC whenever a fault is suspected in their equipment or the system. An extensive system of diagnostic facilities enables the RCC to analyse a suspected fault to determine which maintenance organisation is required to clear it.

The Supply Control Centre will handle directly problems in the computer programs, calling in NDPS support as necessary. The Post Office will be responsible for maintenance of the modem-to-modem links. Faults localised to these lines and equipments will be notified by the RCC to a resident Post Office engineer at the computer centre. He will be responsible for progressing the clearance of faults and for notifying the RCC when the facilities have been restored.

With a project the size of the RAF system there will obviously be changes in the future. At present it is envisaged that the system may well grow to include other RAF stations overseas which are farther afield than those in Germany. Provision has been made in the computer configuration for operation at a higher rate of data transfer than at present. Future changes will certainly include operation at 4.8 kbit/s, and perhaps even higher speeds, with interconnection between the RAF system and the computer systems of Government Departments now being planned.

Mr P. E. Carter is head of a section in the External Telecommunications Executive of the Post Office. Formerly he headed a group at Telecommunications Headquarters responsible for the network planning of telegraph and data systems for government departments.

PO Telecommunications Journal, Summer 1974

LONDON'S BIG SWITCH MOVES AHEAD

DM McIntyre

Seven switching centres are currently being built and equipped in the London suburbs to reduce the flow of trunk telephone traffic through the city centre. The scheme will transform the pattern of trunk call switching in London and have an impact on the routing strategy of the whole country.

LONDON, the largest conurbation in the United Kingdom and its main commercial city, generates more than 20 per cent of the country's trunk telephone traffic. In addition, nearly 70 per cent of the UK international traffic originates or terminates in the capital. Trunk calls are increasing at a very high rate – a tenfold increase is forecast between now and the year 2000 – and the Post Office had to consider whether the policy of concentrating trunk switching centres in central London was correct.

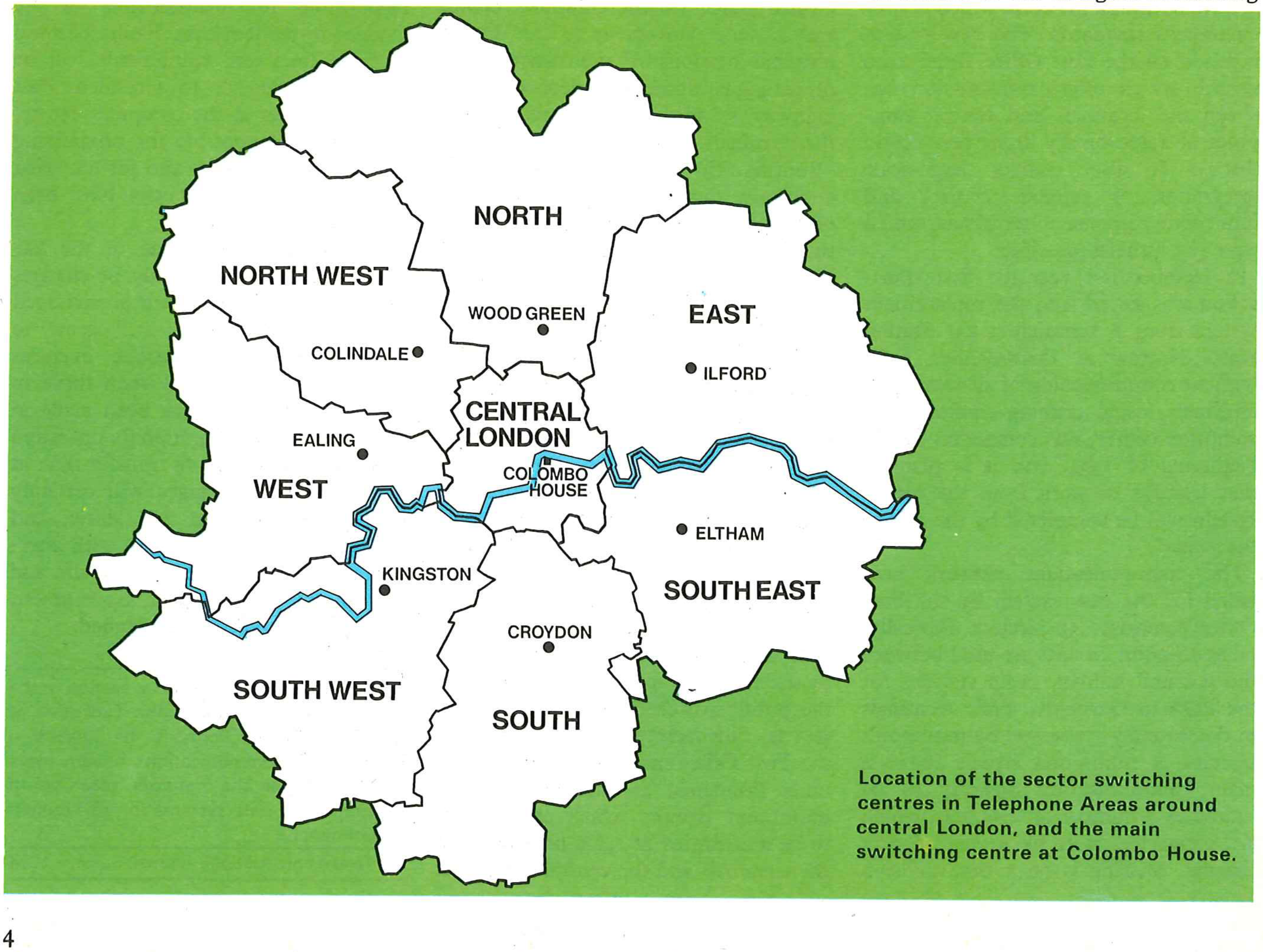
A detailed study by a task force in 1965 recommended that switching of trunk traffic originating and terminating in the London charge group (the 01-area) should be partly decentralised to sector switching centres in the suburbs, leaving only trunk traffic to and from the central area to be handled by the existing trunk switching centres.

One of the main advantages of the scheme was that land could be more easily obtained out of central London. Considerable savings in cable costs could also be achieved by not having to carry traffic for the outer areas in and out of the most congested part of London and by the use of shorter routes from local director exchanges to suburban switching centres.

There were other advantages. The creation of a new cabling plan enabled significant improvement to be made in the transmission of speech over trunk and junction lines and new, larger auto-manual centres could be grouped at the sector switching centres (SSCs), thus providing more efficient units with up-to-date facilities.

Seven SSCs are under construction, located in Telephone Areas around central London. Each centre will have an incoming trunk switching unit, an outgoing trunk switching unit and a tandem unit to switch calls within the sector area and to exchanges in the adjacent sectors. Each sector will have one or more auto-manual switchrooms and a large repeater station.

A feature of the all-figure numbering



Location of the sector switching centres in Telephone Areas around central London, and the main switching centre at Colombo House.

scheme which replaced the use of letters in telephone numbers was that telephone exchanges within the London charge group could be readily identified as being in a particular geographical area or sector from the first two digits of the all-figure number. Each sector has blocks of "first two digits" allocated which permit identification and routing of a call to the required centre. For example, a number beginning 54 is on an exchange within the South West London sector and will be routed to Kingston upon Thames telephone trunk exchange (the SSC) and from there to the required director exchange.

All numbers in the London charge group have the prefix 01. A trunk call from, say, Birmingham to 01-546 1001 will be recognised by trunk controlling equipment in Birmingham as terminating in the London South West sector and will be routed there directly from the Birmingham trunk exchange. It will not, as at present, have to be switched by equipment in central London. Therefore there will be direct lines from large trunk centres in the provinces to each of the London SSCs, and the central trunk switching centres will be relieved of trunk traffic which is not from or to exchanges in the central area. The switching capacity released will be used to take growth, thus reducing the need for new buildings and equipment in the heart of London, roughly an area in a 6 km radius from Charing Cross.

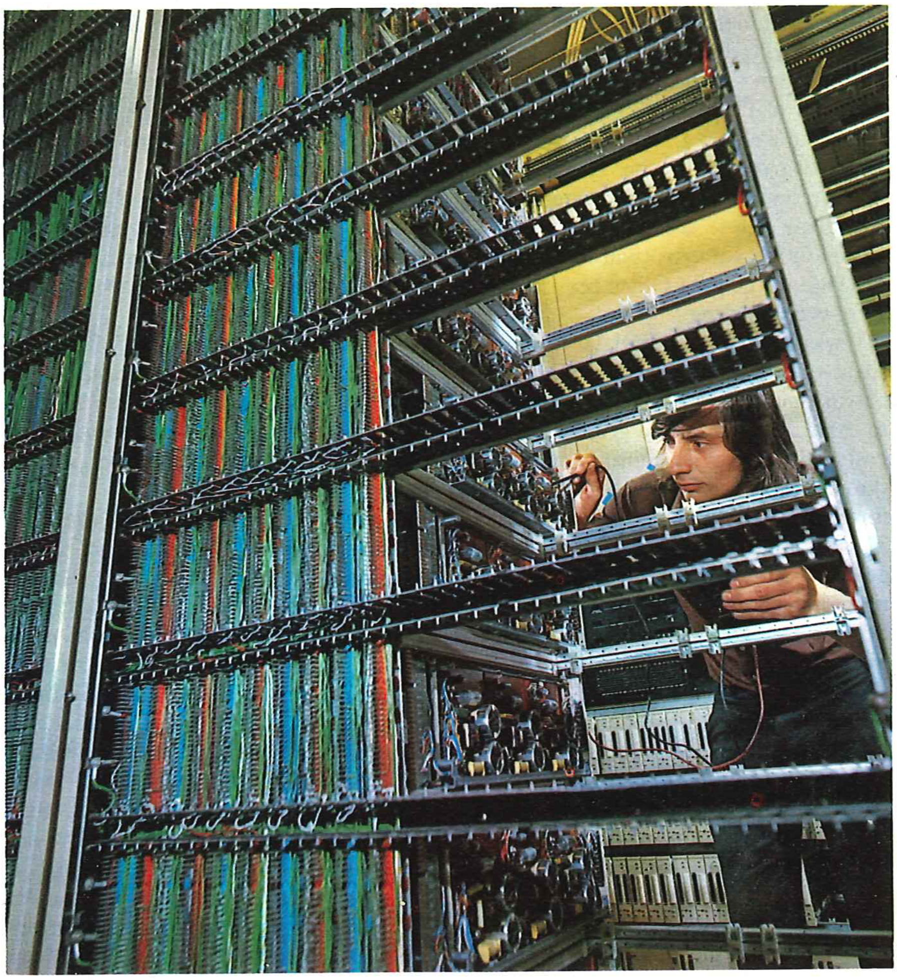
A special trunk switching unit is being installed at Colombo House in central London. While this main switching centre (MSC) has in part the same function as other MSCs in the transit switching plan (see Telecommunications Journal, Winter 1972-73) it differs in some major respects. As well as functioning like any other transit switching centre (TSC) in providing rapid signalled four-wire switching for trunk calls which cannot be routed over the ordinary STD network, its main function is to switch indirectly routed trunk traffic between the London 01 area and group switching centres (GSCs). For example, if Aberdeen does not justify a direct route to the South East London SSC at Eltham calls to that sector will be routed via the MSC, not on the transit network but by means of four-wire circuits (switched four-wire at the MSC) to Eltham SSC. In the opposite direction a London SSC or a central London switching unit (CSU) will route calls via the MSC for places to which there is no justification for a direct route.

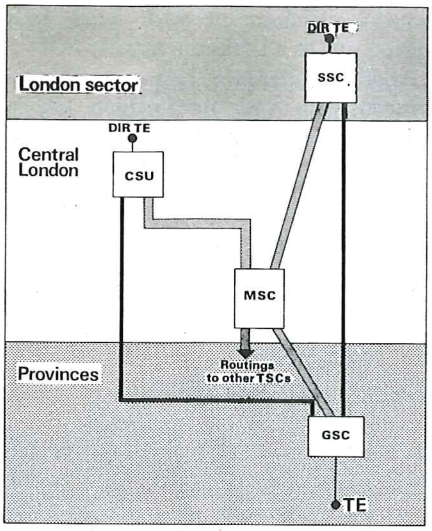
In short, trunk traffic from all the sectors and the CSUs when taken together justifies routes from the MSC to about 100 of the provincial GSCs. Therefore, there will be routes from the London trunk units direct to some large GSCs, routings via the MSC to about 100 smaller GSCs and routing, in accordance with provincial practice via the transit switching network when fully developed to all other places.

Another difference between the provincial MSCs and the London MSC is that the latter carries only transit network traffic originating or terminating in London. Calls from, say, York to ▶

Above: The Wood Green sector switching centre. Its frontage block contains switchrooms and welfare facilities, and there is an apparatus block at the rear.

Below: A Technical Officer carries out a test on stored program control equipment which is being installed in the incoming trunk switching unit at Wood Green.





KEY: DIR TE Director Automatic Telephone Exchange
SSC Sector Switching Centre
CSU Central (London) Switching Unit
MSC Main Switching Centre
TE Local Telephone Exchange – Director or Non-Director
Route switched two wire
Route switched four wire

Simplified diagram of trunk call routings between London and the provinces.

Brighton are not routed via the London MSC or vice versa.

When the decision was taken by the Post Office to embark on the ambitious sectorisation plan for London, the Ministry of Public Buildings and Works (now the Property Services Agency of the Department of the Environment) was presented with a formidable task. Although sites are much easier to obtain in the suburbs than in the centre of London the Post Office requirements were very exacting.

It was not easy to find large enough sites, preferably with room for further extension at places where, having regard to existing plant in the ground, cabling costs would be at a minimum and where the staff could enjoy reasonable travelling conditions and shopping facilities. This coupled with the difficulty of getting planning permission in residential environments meant considerable delay before building could actually get under way.

The actual design of the buildings imposed many difficulties. Often the shape of the site meant that the design had to be something of a compromise between what was desirable and what was acceptable. In addition, local authority requirements for car parking, for elevational design and landscaping had to be taken into account.

By 1969 building was under way at Ilford for the East sector switching centre, and the SSC at Colindale in North West London was started about six months later. Colindale is one of the most complicated building structures, having a frontage block on the main road, two towers and three linking blocks. From the point of view of planning efficiency a simpler building would have been preferred, but the architect had to comply with certain local authority planning requirements and "angles of light" from neighbouring properties.

Kingston and Ealing buildings in South West and West areas, respectively, followed in quick succession. The Ealing building had the advantage of a large site and the design is functionally efficient. To keep the profile to the residential street frontage as low as possible the front block housing the welfare and switchrooms is partially sunk below ground level and has an attractive paved courtyard. The switching apparatus is in a large block to the rear and the blocks are linked by the lift and stairway core. Apart from some minor snags in the ventilation system both buildings are complete. The North SSC at Wood Green, is also a very straightforward building with a frontage block containing switchrooms and welfare and a rear apparatus block.

All the SSC buildings mentioned so far are at present being equipped with TXK I crossbar equipment with electronic stored program control equipment (SPC) using computer techniques. Equipment for detection of faults in the switching units uses the latest technology with service measuring and call trace equipment, print-out of information on teleprinters and other aids to diagnosis of fault conditions.

The sixth sector building has been completed at Eltham in South East London, and equipping has started. This is the smallest of the seven SSCs, with a total floor space area of 162,000 square feet.

Construction of the last and largest SSC of the series, at Croydon in South London, started last summer. It was very difficult to find a site in the right area, and the site was the smallest of all, although the floor space requirements were the largest. The building is principally a large tower with a low wing block for switchrooms and welfare.

The site is alongside a water works which draws much of Croydon's water from artesian wells in the vicinity, and it was not possible to have a building with the usual bored pile foundations for fear of polluting the water supply. The consulting structural engineers devised a double skin raft foundation which is formed of two large flat concrete slabs one over the other and cross-braced between. There is no real basement, only a cable subway, and the cable chamber is on the ground floor. The building has been named Ryland House in honour of the Post Office Chairman, Sir William Ryland, who recently unveiled a commemorative plaque on the site.

The point has already been made that cable economy will result from the sector programme mainly because the lines from director automatic exchanges to the trunk exchanges are much shorter. Lines to the central area thrown spare by the sectorisation will be utilised to meet tandem circuit growth.

It is not necessary, nor is it economic, to bring all three switching units at an SSC into service at the same time. Either the incoming unit or the outgoing unit will be brought into service first. When bringing the incoming trunk unit into service the routes from the provinces need not all be provided at once but the unit must have a complete quota of routes to every local exchange served by the sector at the opening date.

Conversely, to open an outgoing unit does not mean every local exchange must be connected at once, but it does mean that full trunk access to the whole country (and to overseas) must be available. The tandem will generally be last to be provided as this gives maximum economy of cable pairs by re-using pairs released when the trunk units were set up.

The Ilford SSC will be brought into service in stages commencing later this year. It will be followed next year by Colindale in North West London and the others with Croydon, the last, coming into service in about 1980. When the SSCs have been completed and the central trunk units are supplemented by large new telecommunications centres under construction in Paddington and the City of London (see Telecommunications Journal, Summer 1973), London will have an up-to-date trunk switching and line network to cater for trunk growth to the end of the century. Meanwhile, additional sites are gradually being acquired at the sectors adjacent to the present sites and design work has already started for sizeable extensions.

Mr D. M. McIntyre is a Deputy Controller responsible for trunk accommodation planning in London Telecommunications Region, including the London sector switching scheme and the central trunk buildings.

Above: The current standard telex machine, the teleprinter 15, which has a keyboard similar to a typewriter.

20 years of dedicated service

S Whitefield and G Dudley

A FORM OF telex service was introduced in Britain more than 40 years ago which used the public telephone system to send messages between customers' premises. Calls were set up by telephone and when a connection was established both parties switched to teleprinter working to send and receive their messages in type. The service had technical limitations and was unsatisfactory for many calls, mainly because long-distance telephone lines were not always suitable for teleprinter transmission.

As the result of a detailed study started after the Second World War, the Post Office opened a dedicated telex network in 1954. The network had 1,556 lines and calls were connected by 16 manually operated exchanges located mainly in telegraph instrument rooms at Head Post Offices. At the same time, international and inland telex services were combined. Previously, customers requiring international service had to be provided with separate telex lines to the international manual positions at the chief telegraph office in London.

Conversion of the inland telex system to automatic working so that customers could dial their own calls began in 1958 with the opening of pilot exchanges at Leeds and Shoreditch in London. A fully-automatic linked numbering scheme was envisaged with division in the United Kingdom into six operational zones, each zone being sub-divided into charging zones. Conversion to automatic working was completed in 1960 with the opening of Fleet exchange in London. At that time there were 20 automatic exchanges and one manual exchange to handle overseas traffic.

There are now 50 automatic exchanges in operation. The service has grown to such an extent that in London a second exchange, St Botolphs, is now in operation and a third exchange is planned at Keybridge House, the new multi-purpose telecommunications centre now under construction on the south bank of the River Thames. The 50 exchanges include two combined inland and international exchanges, Fleet and St Botolphs. Fleet has an auto-manual switchboard to handle calls to countries not equipped for automatic service.

Almost 50,000 telex machines are in service, including about 13,000 of the first type of machine used when the telex system was introduced. This model, the teleprinter 7, has proved very reliable but is now being phased out. The current standard model is the teleprinter 15. Introduced in 1968, it has many technical and ergonomic improvements, and is designed to blend with contemporary styles of office equipment. A console model has also been introduced which incorporates the dial and signalling unit.

The teleprinter 15 is smaller than the original machine and has a four-row keyboard similar to a typewriter. The machine is available with facilities to transmit messages automatically at a speed of about 66 words a minute compared with an average typist's speed of 35 to 40 words a minute, and can therefore shorten the duration of a call and reduce the call charge. Before making a call for automatic transmission, the message is first typed on the teleprinter to produce a punched paper tape together with a printed copy which can be checked for accuracy. The perforated tape is then loaded into an automatic transmitter on the teleprinter, ready for sending during the call.

Every telex installation has a number and an answerback code which identifies it. Calls are made simply by pressing a button on the dial unit to engage the line and equipment in the telex ex- ▶

Operators in the Coventry telex centre of the Courtaulds Group display a seven-yard telex message sent from the USSR. It lists parts for a plant being built by the Group.

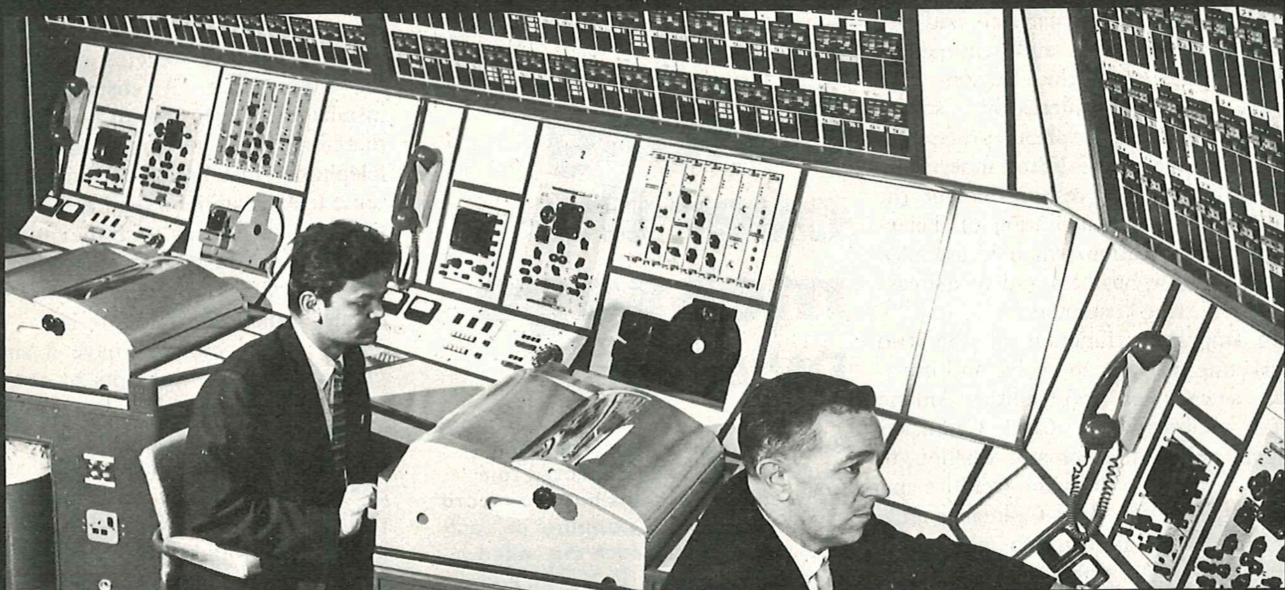
change, and then dialling the required number. When the distant installation gets the call its teleprinter starts automatically and returns a code to confirm that it is ready to receive a message.

In the UK the format used for the answerback code is alphabetic and comprises an identification of the customer and an abbreviation of the post town. Use of this format is strictly applied, with the result that the Post Office has not encountered such severe difficulties in finding satisfactory yet individual answerbacks as many foreign administrations. Subsequently, other countries have adopted a format containing the telex number, and this alpha-numeric format is now recommended by the International Telegraph and Telephone Consultative Committee (CCITT). Apart from precluding duplication of codes the alpha-numeric format has other advantages, such as being much clearer for international correspondence and making computer-controlled procedures more straightforward. Proposals have been made for the UK to adopt this format.

Automatic calling and answering equipment for use on the UK telex network was introduced at the end of 1970. Called Data Control Equipment (DCE) No 3A, it allows calls to be answered automatically by a customer's private data equipment, such as a computer. When the DCE 3A is fitted with an automatic dialling device, the customer's computer can also initiate and control outgoing calls, dispensing with the need for operator intervention at any stage in transferring messages or data from one telex user to another.

Telex service has been steadily extended to most other countries, and the Post Office has developed facilities which enable customers in Britain to dial most of their own overseas calls. International Telex Subscriber Dialling (IXSD) was introduced to Western Germany in 1961 and the system has been extended to more than 65 countries. Currently 97 per cent of outgoing UK international telex calls are dialled.

An extension of the international gateway exchange at St Botolphs scheduled to open in 1976, will use stored program control (SPC) techniques and will be the first of its kind in the UK telex network. The SPC system makes use of a central computer to set up calls quickly using electronic techniques. It offers facilities such as the store-and-forward of messages, abbreviated dialling, auto-



Top left: A perforated tape bearing a message is loaded into the automatic transmitter of a teleprinter 15. It can transmit at about twice the speed achieved by an efficient typist.

Top right: The Card Callmaker takes the effort out of dialling telex calls. A punched card of the required number is simply slotted into the unit to set up a call.

Above: Fault control consoles in London's Fleet Building. International long-range radio telegraph circuits are controlled from these positions.

matic second attempt to set up calls and automatic re-routing.

In the past difficulties were experienced in timing automatic international telex calls to countries beyond Europe and over radio links. These calls had to be connected manually, or when switched automatically used teleprinters to record the charging details for subsequent manual preparation of call tickets. In 1969 a new system was planned to overcome the difficulties. Charges for calls beyond Europe are now handled by the Intercontinental Telex Automatic Ticketing (ITAT) system at Fleet and St Botolphs exchanges, which uses tape punching machines to record charging information on paper tape. These tapes are later processed by computer for customer billing and international accounting purposes. ITAT was first introduced on routes to Canada and New Zealand, and is now available for 37 countries. Charges for international calls to overseas destinations for which IXSD is not available are recorded manually by the operator.

International telex is carried over channels derived from intercontinental telephone circuits, both via cables and satellites, and telex service for ships at sea is provided by radio links to Post Office coast radio stations. At present the Post Office maritime radio teleprinter services have a world-wide long range coast station at Burnham, Somerset, and short range stations at Stonehaven and Cullercoats. There are plans to augment these facilities with installations at Norwick, Ilfracombe and North Foreland. The possibility of a fully automatic service via satellite to ships at sea when a maritime satellite becomes available is being considered.

The feasibility of providing connection for ships in dock is being investigated to encourage shipowners to install telex in more of their vessels.

To provide privately rented teleprinter services to barges laying oil pipelines in the North Sea, additional radio teleprinter facilities have already been provided at Humber. They should soon be available at Stonehaven, and eventually

at Norwick. Private teleprinter facilities, as distinct from the telex public service, have been provided to the North Sea oil rigs for some years from coast stations at Humber, Stonehaven and Norwick.

Although the UK telex system had only 1,556 customers 20 years ago, market penetration will pass the 50,000 mark this year. The rapid expansion has been achieved by considerable service improvements, world-wide availability and sustained marketing efforts. In each Post Office Telecommunications Region and Telephone Area throughout the country a marketing officer implements and controls local selling campaigns. A marketing group at Telecommunications Headquarters (THQ) analyses demand and supplies statistics to formulate forecasts for budgeting and policy purposes.

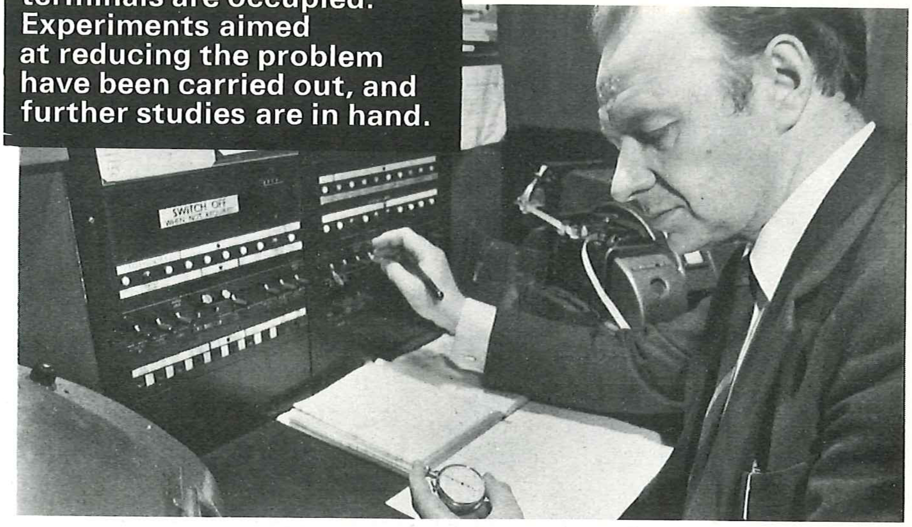
The group at THQ is responsible for initiating publicity material and for arranging exhibitions and seminars in co-operation with the Regions and Areas. Several successful selling campaigns aimed at various professions and industries have been undertaken. The group is also responsible for the publication and distribution of Telexpress, a publication which is intended to attract new business and to increase use by existing customers.

An important function of the THQ marketing group is to evolve and introduce new services and facilities. Among these facilities is a Card Callmaker which provides automatic dialling of telex calls. It has the same facilities and is identical to the Card Callmaker units which can be attached to telephones. The digits of a number are punched in a pattern of holes on a plastic card, and to make a call the card is dropped into a slot in the Callmaker unit.

New telex machines are being developed which will use electronic techniques in place of some of the electro-mechanical features of present machines. Some of the possible advantages of such machines are that they will be more compact, smaller, lighter in weight and easier to maintain. An extension telex facility is also planned, working on similar principles to the extension telephone. This would enable calls to a customer's main teleprinter to be connected to an internal or external extension unit, and allow intercommunication between the main unit and the extension.

Mr S. Whitefield and **Mr G. Dudley** are in a group at Telecommunications Headquarters which deals with the promotional aspects of telex marketing.

Telex calls are frequently delayed because the called terminals are occupied. Experiments aimed at reducing the problem have been carried out, and further studies are in hand.

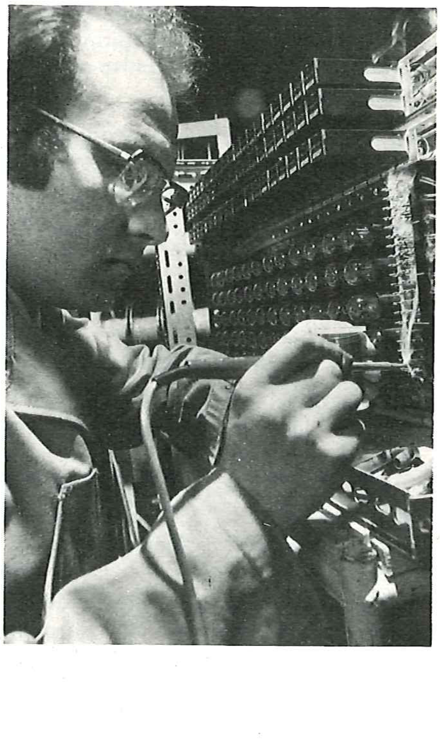


Above: A telex call is sampled at the service observation desk in Fleet exchange, London. The supervisor records details such as the time taken for connections to be made and any ineffective calls.

Putting over the message

DN Austin

Below: This prototype metering equipment can be connected to a large number of telex lines to record the number of call attempts on each line which fail because the called terminals are busy. Designed and built at Telecommunications Headquarters, it has already undergone a field trial.



COMMUNICATIONS which combine the speed of connection of the telephone with the authority of the printed word are provided by telex, the public teleprinter service operated by the Post Office. A customer's telex installation is complex and the rental is therefore high in comparison with a telephone installation. Consequently, some telex customers tend to limit their number of terminals, with the result that more than a quarter of all attempts to set up calls over the network fail because called terminals are busy.

Most other countries have a similar problem, and call attempts to occupied terminals are indicated by the internationally agreed code OCC. The problem causes frequent delays and frustration to customers in the connection of their telex calls. If the problem could be overcome it would result in a better and more efficient service. It would also make some savings in network plant by avoiding situations where trunk lines and equipment are engaged with non-revenue earning traffic.

Most installations have single terminals and customers are reluctant to rent additional equipment until they feel it is absolutely necessary. Executives of firms rarely dial their calls as they do with telephones, so it is unlikely that they are aware of any difficulties experienced by their telex operating staff. In any case, neither the executive nor the operator would normally realise the congestion which may be created when their terminal is in constant use. Even if they are aware of the congestion caused to incoming traffic, they do not often seek to rent additional lines and terminals simply to permit other users to make calls to them more easily.

In the late 1950s the telex network was converted from manual to automatic switching. This enabled customers to set up their own calls, and the popularity

of the service greatly increased. As use of the service expanded the OCC problem also grew and has been studied on several occasions. The extent of the problem has been gauged from centralised service observation – that is, by sampling calls throughout the working day and recording details such as the number dialled and whether the call is effective. The observation equipment can handle only a very small percentage of call attempts made on the telex system. Therefore, although the percentage of call attempts resulting in OCC can be calculated, the observation results give very little indication as to which terminals are the major cause of the problem.

A few meters are provided in each telex exchange and these can be connected to customers' lines to register the number of occasions when a caller experiences OCC because the called line is engaged. However, this is a laborious method of ascertaining from the present 49,000 telex lines in service those terminals which cause the most OCCs.

Analysis of customers' accounts can give an indication of busy terminals, on the basis that those with large accounts are making many calls per terminal, which are therefore more likely to be busy. It is only a rough guide because a customer may be making only a few, relatively expensive overseas calls, or the nature of his business may require him to receive many calls but originate only a small number.

Several attempts have been made to identify busy terminals so that the customers can be approached to rent an additional line and terminal equipment. The extra number of terminals rented as a result of these time-consuming exercises has been disappointing, even when as an incentive a reduction in rental has been offered for two or more terminals. Lack of response arose mainly because no convincing benefit to the customer could be claimed to offset the additional expenses.

Two years ago the earlier work of attempting to reduce the OCC problem was reviewed. It became apparent that despite all the efforts put into the problem, the effect that an additional terminal would have on telex traffic and the OCC rate was mainly a matter of conjecture. For example, it was not known by how much the OCC rate would be reduced by an additional line and terminal, nor to what extent – if at all – the customer would then make more revenue-earning calls. Another unknown factor was whether effective calls to a customer were suppressed because callers eventually abandoned trying to contact a line that was frequently busy and, if this was the case, by how much these calls would increase when the called customer had extra equipment.

Further, it was not known when these changes in traffic would occur during the working day. If the increase in calls coincided with the telex network's busiest hour of the day its switching equipment would have to be increased. However, if the increase occurred at other times the additional traffic could be carried without augmenting switching equipment.

It was decided to carry out an experiment among selected customers who received and originated a large number of telex calls. The object of the experiment was to assess the effect on traffic and the OCC rate of providing a second line and terminal equipment, and to ascertain whether the results could give some indication as to what further action might be taken to reduce the general level of OCCs.

Recordings were taken from each selected customer's line throughout every working day for one month. The recording indicated the duration of each call, whether it was incoming or outgoing, and when each incoming call attempt resulted in the caller receiving OCC. For the following month the customer was provided with a second line and terminal and the record was repeated for both lines.

The experiment was confined to seven installations because of the limited amount of special recording equipment and staff available to analyse the large quantity of data produced. Results were varied but, briefly, the addition of a second line reduced the average daily OCC rate by 73-93 per cent and increased the average hourly effective incoming traffic by 5-30 per cent. In addition, the outgoing traffic increased by 3-40 per cent. Results of the experiment were not made known to the customers, but at the end of the experiment, four of the seven customers decided to retain their second line. Another customer would have done so if that particular business had not been about to close.

Within the limitations of the small sample, the experiment indicated that a second line for telex customers who made high use of their installations reduced the OCC rate and contributed to improving the quality of the telex service. A proportion of the calls failing as a result of OCC on single lines represented suppressed incoming traffic which a second line allowed to be set up. The second line also resulted in increased outgoing traffic, suggesting that a busy single line suppressed outgoing calls. The busiest hour of the day differed for each customer with a single line, but with a second line the busiest hour tended to occur between 4 and 5 oclock in the afternoon.

Probably the most significant indication from the experiment is that busy customers might rent an additional line if it is provided initially for a trial period. Clearly the cost of providing lines in this way must be evaluated against the probability of retention.

Studies are in hand to assess the savings that a reduction in the OCC rate might secure by avoiding the provision of switching equipment to carry ineffective traffic, together with the increase in effective revenue-earning traffic previously suppressed. In addition all customers in the experiment are to be questioned to discover why they did or did not retain their additional line and why an extra line had not been rented previously. Results of these studies and investigations will be used to formulate a standard marketing procedure.

Prototype recording equipment consisting of 80 meters has been built and tried out in the field. This equipment will aid the marketing campaign by enabling considerably more lines to be checked to identify those which create the major portion of OCCs.

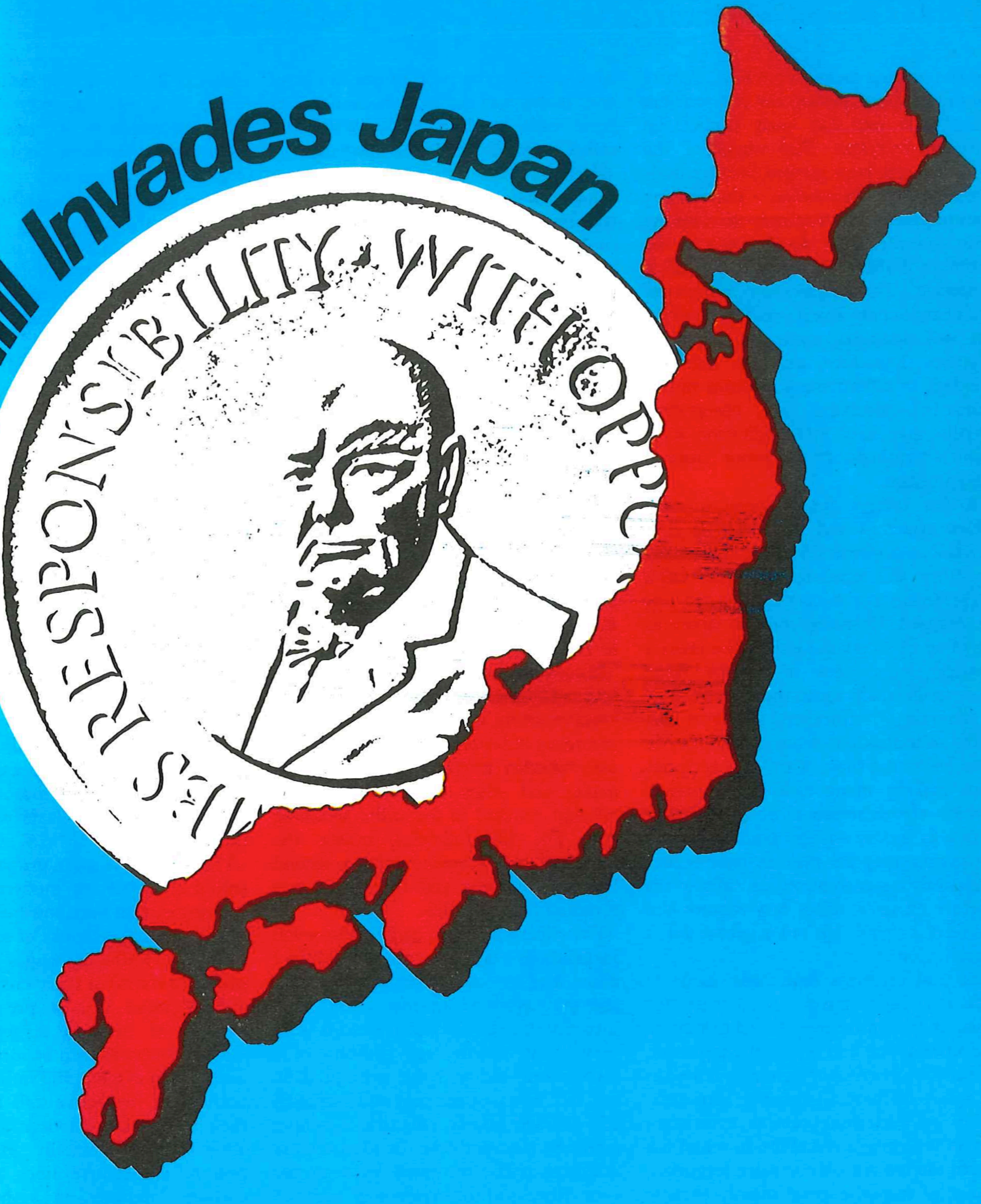
The OCC problem can probably only be solved effectively by modern electronic exchanges, which are now being installed in the national networks of several other countries. These exchanges can readily provide a record of every customer's line causing more than a pre-determined number of OCCs in a given period. Customers could then be identified with a minimum of effort and informed of the number of ineffective call attempts to their installation. Modern systems also allow complete flexibility in the allocation of consecutive lines wherever a customer requires an additional line. This is not always possible with present electro-mechanical systems.

Modern electronic exchanges also offer other possible facilities for reducing the incidence of OCC. For example, if a called customer's line is engaged, the system can be designed to observe when the line becomes free and then automatically connect the lines. It is also possible to store a message from the caller and transmit it to the called terminal when the line becomes free.

Mr D. N. Austin is head of the section in Network Planning Department at Telecommunications Headquarters which is responsible for planning and provision of equipment for telex and telegraph networks.

PO Telecommunications Journal, Summer 1974

Churchill Invades Japan



Long-range studies, maintenance and data networks were the subjects chosen by three Post Office staff who last year received Churchill Travelling Fellowships to study telecommunications in other countries. Although their subjects differed, all three chose to visit Japan for either the whole or part of their studies. They relate their experiences in the following pages. (Reports from other Post Office Churchill fellows, who visited North America, appeared in the Spring 1974 issue of the Journal.)

The fellowships – in the form of financial grants – were awarded by the Winston Churchill Memorial Trust which gives men and women from all walks of life the opportunity to travel abroad to widen their knowledge in a nominated field of activity. Each year the Council which manages the Trust selects categories to be studied, and all UK citizens may apply for a fellowship regardless of their age or professional qualifications. Selected applicants spend an average of three months overseas and are then asked to report on their studies. A special medallion, shown on these pages, is awarded to each person on successful completion of their fellowship.

● Details of 1975 fellowships can be obtained from The Winston Churchill Memorial Trust, 15 Queen's Gate Terrace, London S.W.7. Applicants should send their name and address only, on a postcard between 1 Sept and 1 Nov 1974.

A long look ahead

DB Hoodless

A NUMBER of theoretical studies are being carried out in Japan to assess the part telecommunications will play in the future development of the country's society. To this end one project is attempting to define communication, what information is and the problems which exist in communicating. Their view is that the more that is known about communication, the better the understanding of the role of telecommunications. Other studies are concerned with the impact of environmental problems on society, the information needs of individuals and how others respond to communication.

These projects form an important part of the work of Japan's Research Institute of Telecommunications and Economics (RITE). The Institute was founded in 1967 by organisations with interests in telecommunications and is a non-profit making body. Its particular interest is in the social sciences, and much of the research undertaken is in this field.

Among the organisations which set up RITE were the Ministry of Posts and Telecommunications, the Nippon Telegraph and Telephone Public Corporation (NTT), the Kokusai Denshin Denwa Company (which is responsible for overseas services), and the Japanese Broadcasting Corporation (NHK). These organisations are the major clients for the Institute's research. Other clients include plant and equipment manufacturers' associations and have even included municipalities such as Yokohama City.

A research programme is drawn up each year and agreed with the clients. The work covers many fields of activity and inevitably tends to have its emphasis on long-range studies. For example, one project is attempting to visualise the Japanese telecommunications systems 10 years ahead. The current rapid growth in telephone connections throughout the country will slow down eventually, and the study is trying to assess which new services will grow rapidly in the future. In another project 1,500 Japanese housewives are being interviewed to provide information for evaluating the role of telecommunications in the home.

RITE is also concerned with surveying development trends in other countries. Notable among these studies is a review of all-purpose cable networks for cities in Europe and the USA, in which interest has been shown in the Milton Keynes project in Buckinghamshire (see Telecommunications Journal, Autumn 1972). Another important project is looking at trends in international data communications.

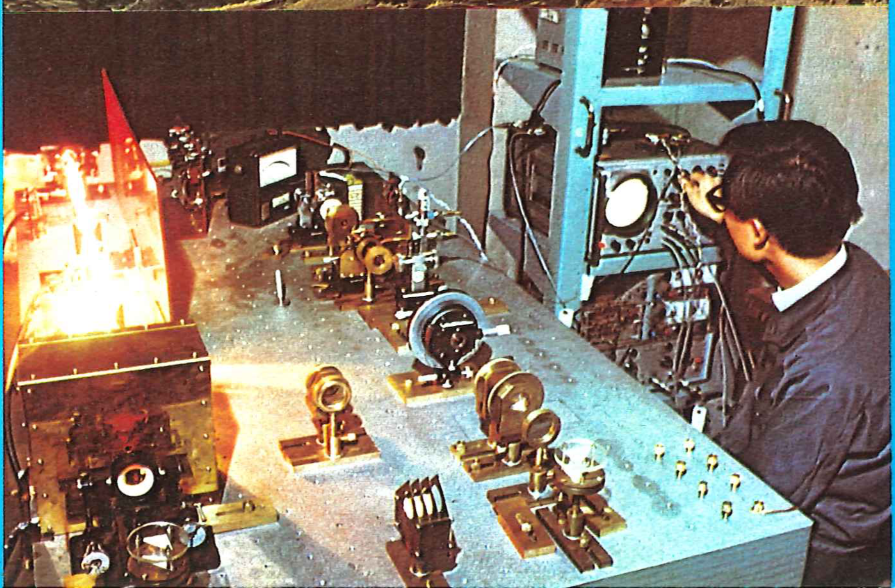
An interesting feature of the Institute is the status of its employees. Of a total staff of about 70, most of whom are research workers, only three permanent researchers are currently employed. All other research workers are seconded from sponsoring organisations and work at the RITE for a period of two to three years. Commercial banks also send staff to work for the Institute. To date 80 people have spent time there as research workers since it was set up and are now continuing their careers with their own companies. The Institute is also considering the possibility of exchanging personnel with other countries, and the British Post Office is among those organisations with which it would like to pursue the idea.

NTT, which has a monopoly of domestic telecommunications services in Japan, is already extremely active in the field of

Donald Hoodless is an economist in the Statistics and Business Research Department at Post Office Central Headquarters. At the time of his Churchill Travelling Fellowship he was seconded to the Long-Range Studies Division at Telecommunications Headquarters. During a six-week study trip to Japan Mr Hoodless investigated how long-range studies were carried out there and examined the organisation of telecommunications services.

Below: Japan's Mount Fuji towers behind a relay station which forms part of a microwave transmission system for long-distance trunk telephone lines.

Bottom: An experiment is carried out on laser communications during studies of a possible large-capacity transmission system for the future.

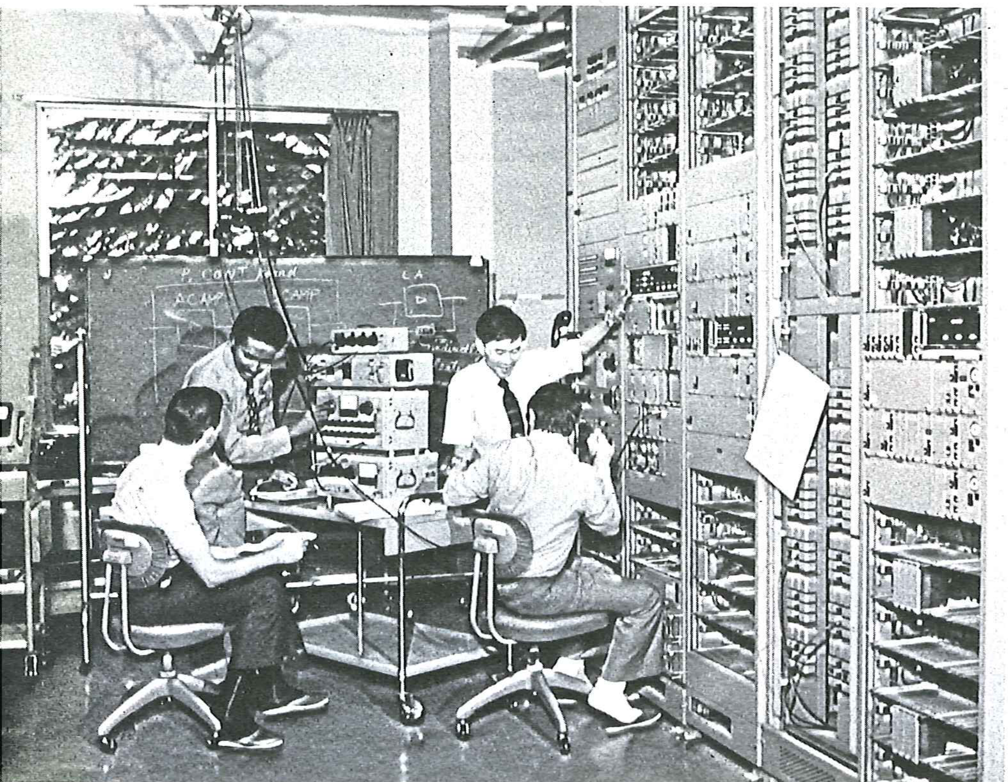


international co-operation. The corporation has an International Affairs Bureau, headed by a director whose function is to assist and liaise with other countries, as well as the collection of overseas telecommunications data. Much of the bureau's work is in providing hospitality to foreign visitors, particularly those from developing countries.

To meet the growing demand for domestic telecommunications services NTT plans five years ahead, but the plans are not rolled forward. Thus since it became a public corporation in 1952, four five-year expansion programmes have been completed (see Telecommunications Journal, Summer 1973). The current programme – for the financial years 1972 to 1977 – forecasts the addition of 15,300,000 subscriber lines, and at the end of this planning period it is expected that 75 per cent of Japanese householders will have a telephone. Two-and-a-half million people are currently on the waiting list, and a fundamental aim of the programme is to meet all unfulfilled demands for service.

NTT has a very large capital programme to meet the growing demands for service, but very little of this money is raised by borrowing from the Government. In the financial year 1972, for example, internal funds (depreciation and a small surplus) accounted for 43 per cent of NTT's capital requirements and the rest was met by external funds. Some 55 per cent of the external funds were provided by the compulsory sale of bearer bonds to new subscribers and 22 per cent came from installation charges. Another 17 per cent was raised by the sale to the public of bonds which have an interest rate guaranteed by the Government, and only five per cent came directly from the Government.

NTT is very active in the field of international co-operation. Here an overseas visitor exchanges opinions with Japanese engineers.



The compulsory sale of bonds to new subscribers appears to be an attractive method of raising money. Their cost varies from 20,000 yen (about £30) to 150,000 yen (about £230) in large cities such as Osaka and Tokyo, but the bonds can be sold as soon as they are purchased – and more than 80 per cent of subscribers do so. The bonds are claimed to have an attractive interest rate and are therefore very marketable, being sold to security corporations.

The interest rate on the bonds changes occasionally. If the rate rises, the price of the bonds falls and subscribers lose money when they sell them. On the other hand, if the interest rate falls the price of the bonds rises and subscribers selling them make a capital gain. A fall in interest rates occurred in 1972 at a time when the Japanese Parliament, the Diet, was renewing the law on the compulsory sale of these bonds. If the situation had been reversed NTT may well have had more difficulty in getting the law extended for another 10 years.

NTT's investment programme is more than £1,500 million a year, which represents a considerable proportion of the turnover of all Japanese telecommunications manufacturers. The final decision of allocation of equipment orders rests with NTT and depends on a number of factors. Emphasis is placed upon quality, reliability and technical performance, but an historical pattern of ordering and the reputation of each firm also have a great influence.

Manufacturers in the Japanese telecommunications industry follow NTT's investment programme, and there do not appear to be any dramatic changes in ordering patterns from one year to another. Companies stated that they had no problems in forecasting the size of the total market for telecommunications equipment as NTT's plans were known and accurate. By knowing the total size of the market the firms knew with great accuracy their total share of it.

Competition between manufacturers shows itself in other ways. NTT decides with the companies which research and development activities will take place, and these are usually in the traditional areas that each company has supplied to NTT. A manufacturer's research is therefore carried out primarily to protect its existing markets with NTT. However, a company will also promote its own research to prove that it has the capacity to supply equipment in other fields, and to do so may have to invest heavily over long periods of time. Firms therefore compete through research and development, and as a result there is often a duplication of effort.

Although manufacturers compete in the market for telecommunications equipment they actively co-operate with each other to forecast the size of the market through the Telecommunications Industry Association. This is a research organisation financed and supported by the companies, and they supply part-time researchers to collect statistics on every product.

Market forecasts, in terms of value and volume, are made five years ahead. Every member company gives an opinion, views are exchanged and then figures and forecasts are agreed. The published results, which are available free to members and other Japanese suppliers, were described as the "manufacturers' bible".

NTT feels it has a positive role to play in ensuring the continued development of the Japanese telecommunications industry. The corporation is expanding its efforts in the field of international co-operation, for example in the technical aid programme for developing countries sponsored by the Japanese Government and the International Telecommunications Union. It also participates in conferences organised by the International Telegraph and Telephone Consultative Committee and the International Radio Consultative Committee, as well as exchanging information on technical and managerial problems with other countries. By undertaking activities of this kind NTT hopes to play an effective part in fostering better mutual understanding of telecommunications among different countries.

Too old at twenty-five

J Brown

MOST OF the 100,000 engineers employed on maintenance in Japan's telecommunications services are under 25 years of age. The reason is that the Nippon Telegraph and Telephone Public Corporation (NTT), which operates the country's domestic services, regards maintenance as the most demanding and monotonous job of all those carried out by its employees. At the age of 25 maintenance engineers may be either promoted or moved to less demanding jobs in which they retain the same status.

All new engineering staff are first employed and trained in maintenance work, and nearly one half of NTT's 100,000 engineers in this field work on subscribers' apparatus, lines, underground plant and power equipment. Another 35,000 work in telephone exchanges, and the remainder are divided among those groups maintaining transmission in repeater stations, microwave systems and data services.

The demand for engineering staff is met by recruiting graduates from high school and university. High school graduates sit an entrance examination and on passing are awarded courses of several months at an NTT training school.

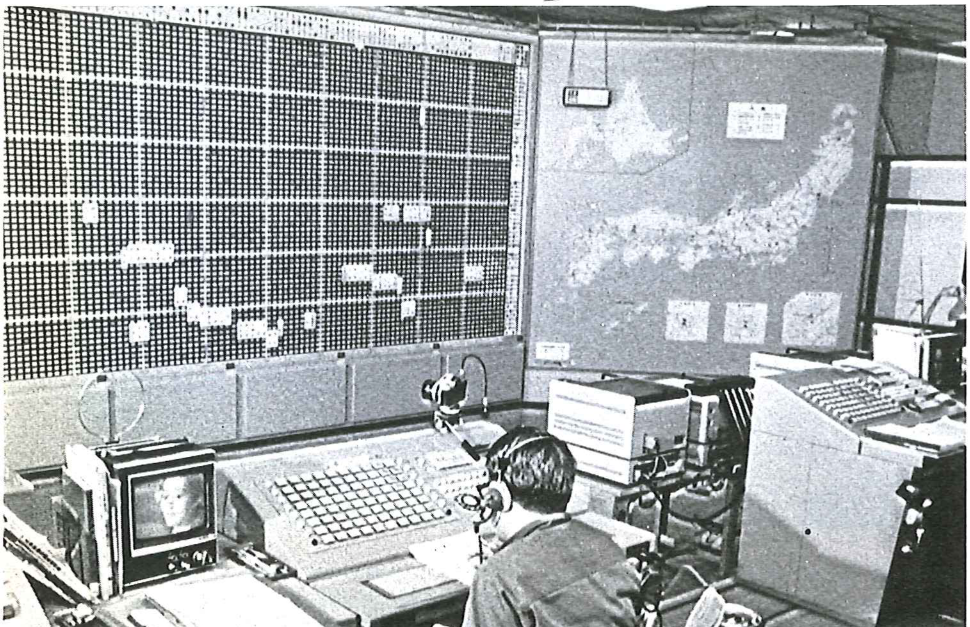
James Brown made use of a Churchill Travelling Fellowship to spend two months in Japan studying the maintenance organisation of the country's telecommunications service. Mr Brown is a Technical Officer at Woodcroft trunk switching centre in Edinburgh where he is employed on the maintenance of switching equipment.

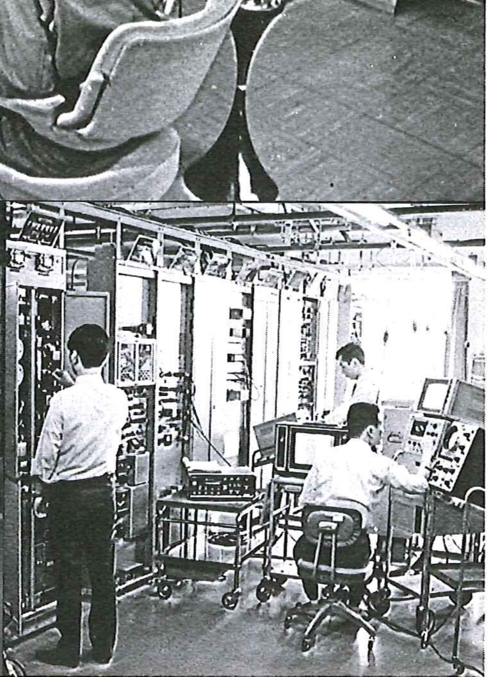
On completion of his course the high school recruit is sent to a maintenance group in a telephone area. Here two months' instruction is followed by 10 months' practical work on crossbar exchange equipment, which forms the largest part of Japan's telephone system. At the end of this year in the field a further month's study is carried out at the training school, and the recruit is then sent to an exchange as a fully trained maintenance engineer.

The university graduate applying for an engineering job with NTT also sits an entrance examination. If successful – and after a three-year training period – he is given a responsible post carrying out the functions of an administrative engineer at either the headquarters of NTT or its telecommunications bureau. The bureau assists and liaises with both the Japanese telecommunications industry and overseas administrations.

There are about 23 million subscribers in Japan, and the telecommunications services are maintained on an area basis. Each area, in which there are between 40,000 and 50,000 subscribers, has a central office with its own group responsible for all aspects of maintenance. Staff work on a six-month rota basis, covering every type of maintenance work. This relieves the monotony of working on only one type of equipment.

A group maintains all exchanges and equipment in the area used by NTT, and its work also includes the re-location of apparatus in customers' premises and ▶





Top left: The trunk network control room in Tokyo which supervises long-distance, directly dialled calls. If any breakdown or severe congestion is detected on the network, re-routing of calls is controlled from this room.

Far left: A DEX-10 electronic switching system which can serve up to 40,000 subscribers.

Left: NTT has 13 telecommunications institutes in various parts of Japan where staff who will support and promote the corporation's services are educated and trained. Here at the Central Telecommunications Institute in Tokyo students undertake technical training.

Different types of coinbox telephone installation in Japan can generally be identified by their colour.
Above left: Red telephones are the most common types seen in shopping areas, underground stations, and the like.
Above: Blue telephones are installed in the kiosks of towns and cities.

the re-routing of poles, ducts and cables resulting from outside construction work. The group controls all mobile exchange equipment and power plant, and has other responsibilities such as payment to landowners for pole sites, surveys of buildings and installations and field trials of new equipment.

Maintenance groups also run their own training programmes. Training is first given on crossbar exchange working, and is followed by more complex and specialised work. It has been found that maintaining step-by-step switching equipment requires special techniques. Crossbar gives much less trouble, the most common faults being RWT (right when tested) and FNF (fault not found). Although some faults on crossbar equipment take three or four times longer to locate than on step-by-step equipment, repair can be carried out much quicker. Therefore the maintenance effort is basically the same for the two types of exchange, provided they both have the same fault rates.

A programme to install 17 electronic (DEX-10) exchanges was completed earlier this year. These exchanges use miniaturised crossbar switches for the speech path, and stored program control in which the call processing logic is concentrated in a central processor. DEX-10 exchanges can each serve up to 40,000 subscribers. Specialist training in electronic exchanges of this type is creating new problems because staff must be taught about computer equipment and techniques. Maintenance of data circuits also requires special training because of the critical factors governing data transmission.

To report a fault in Japan the subscriber dials a number which gives direct connection to a maintenance control point in the central office. Emergency repair is given on a 24-hour basis by NTT.

The staff employed on external duties at city exchanges work from 8.30 am to 5.10 pm, but a two-shift system is

operated in some of the areas. Internal staff work on a 24-hour rota.

Many exchanges with less than 10,000 subscribers are unattended, and external staff work from 8 am to 5 pm. In this case all faults reported after 4 pm are either carried forward to the next day or cleared by overtime working. However, the two-shift system is implemented if warranted by the amount of work, and this has greatly reduced the number of faults carried forward.

NTT still wishes to improve on its current maintenance figures, and external maintenance staff in the city of Nagoya are working on a 24-hour rota.

Priority in maintenance work is now being given to reducing both the number of faults carried forward and recurring faults – that is, those which occur three times in six months.

Quality control was introduced into all aspects of maintenance work in Japan 20 years ago. Operating efficiency standards were applied to most telephone exchanges at roughly the same level, and an exchange control limit value was set for each exchange. This limit value was based on the number of faults occurring at an exchange, and took into account such factors as the type and age of the equipment. Any exchange which exceeded the limit value was completely overhauled. The system proved very successful in that the number of exchanges exceeding their limit value was reduced from 90 per cent in 1957 to only 0.1 per cent in 1972.

Various types of coinbox can be found throughout the country. Many of these telephones are movable or portable, and the different types can generally be identified by their colour. For example, red telephones are the most common types seen in shops, stores, underground stations and the like, and are designed to accept coins mainly for local calls.

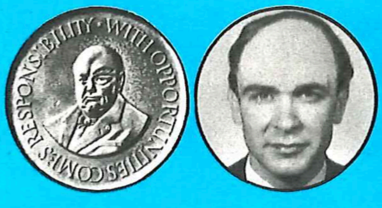
Pink telephones are found in bars, restaurants and clubs. Kiosk telephones in towns and cities are blue. Yellow telephones, which accept larger denominations of coin, are provided in watertight cases mounted on telephone poles at the roadside and also in kiosks.

It is interesting to note that coinboxes in Japan do not suffer from vandalism. This has no doubt been a factor in the success of efforts to reduce the rate at which faults occur. Over a 10-year period in 1972 the fault rate among red and pink coinbox telephones was more than halved, while that of the blue and yellow kiosk-type telephones was reduced by more than 90 per cent.

The reduction in both coinbox faults and those of other customers over the 10-year period were attributed to a number of developments. Among the reasons given was a new design of telephone to provide better transmission, and the use of gas-filled cables which give early warning of damage to underground plant. The introduction of plastic-sheathed cable, giving greater protection to circuits, and the phasing out of step-by-step exchange equipment for crossbar and electronic equipment also helped to reduce fault rates.

The growing demand for data services

R Foster



Robert Foster was awarded a three-month Churchill Travelling Fellowship to study data network developments by telecommunications administrations and companies in Japan and North America. Mr Foster is an Executive Engineer in the Telecommunications Systems Strategy Department of the Post Office, in a group undertaking technical evaluations of digital data exchanges.

SIGNIFICANT growth in demand for data communication services is occurring in Japan, the United States of America and Canada. Demand is increasing as industrial organisations and government departments discover a growing need for access to central computers from terminals spread over wide areas.

At present data transmission in these countries is provided mainly by conventional telephone and telegraph channels. However, rapid developments are taking place both in Japan and North America in the planning of digital data networks which can accommodate a wide range of terminals with low rates of error in transmission. Digital transmission reduces the effect of circuit noise, substantially increases the rate at which information can be transmitted for a given bandwidth, and simplifies the mixing of various kinds of services – such as data with voice or video – to minimise total costs.

The Nippon Telegraph and Telephone Public Corporation (NTT) provides all domestic telecommunications services in Japan, and prior to a revision of the Public Telecommunications Law in 1972 no use could be made of the switched public network for data transmission except by NTT. In addition, there were considerable restrictions on the use of leased communications circuits with computer facilities. Now that computer access is allowed over the telephone and telex networks, several private companies are able to offer computer time-sharing services. NTT provides the communication circuits – but not the computers and terminal equipment – for most on-line computer systems, although it can supply complete systems.

Three public time-sharing computer services are offered by NTT, using the public switched network. NTT provides central processing equipment at a Public Data Centre, together with communication circuits and data terminal equipment in customers' premises. Customers can subscribe to this public data communications system in a similar manner to the telephone service, sharing the central computer facilities.

One of NTT's time-sharing services, called DIALS, allows the customer to make calculations from a push-button telephone (keyphone). At present there are 300,000 keyphones in service in Japan, and it is anticipated that the number will rise to 3,800,000 by 1978. After establishing a connection with the Public Data Centre, the customer can key in an input on his telephone and receive an audible recorded answer within a few seconds.

Various types of calculation can be made by the DIALS service. For example, it can handle direct calculation of mathematical problems input by customers, such as addition, subtraction, multiplication, division, raising to a power and determining square roots. Other calculations can be carried out by a stored program. This is a computer program with unspecified variables prepared by the customer and stored in the computer. Calculations are processed ▶

following the input of corresponding actual values. Customers can also use library programs prepared by NTT, for example, to calculate compound interest and to solve simultaneous equations. To receive the results, the customer simply keys in the title of the required library program together with his data.

A management information system for small and medium sized companies is provided by another of NTT's time-sharing services. Known as DRESS, the service allows a customer to store information at the Public Data Centre and to gain access to it when required. NTT provides the systems design service for the customer, preparing all the necessary computer programs. Updating and enquiries to file are made by entering the required commands and data on a keyboard printer in the customer's premises.

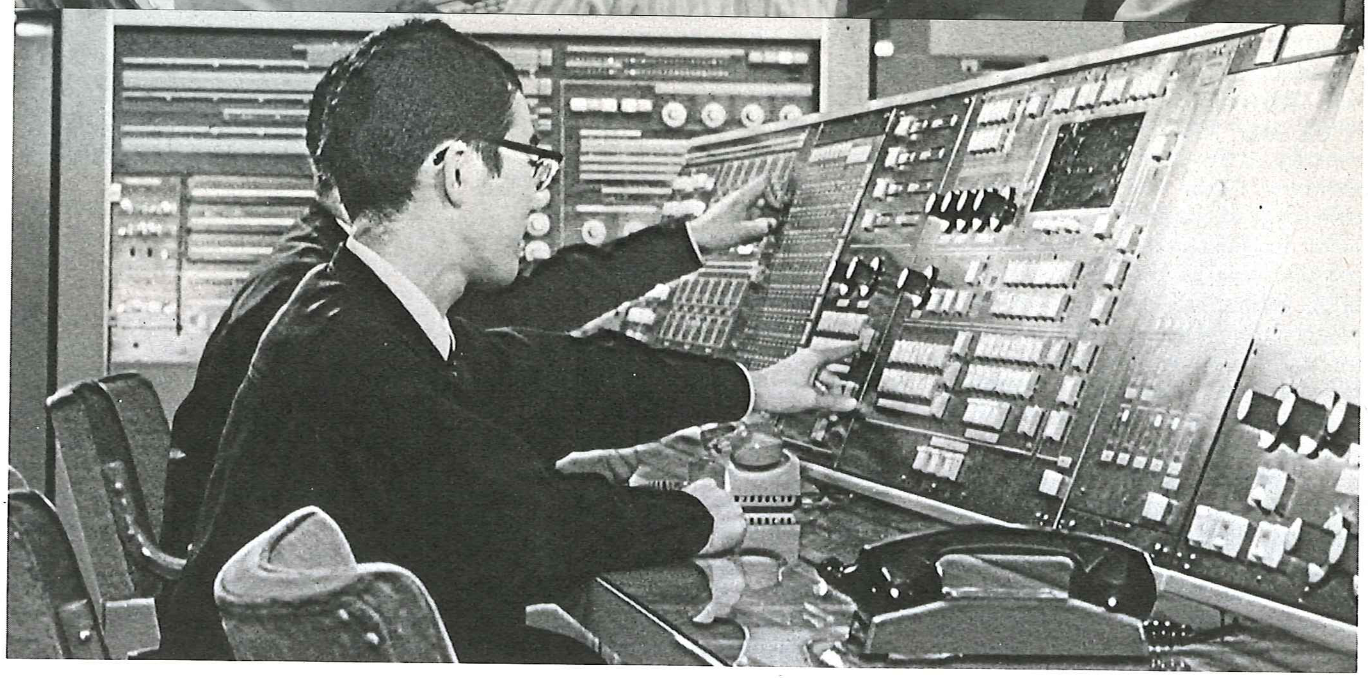
The DRESS service enables a customer to gather information which may be widely spread among his branch offices, using the public telephone network for storage in a private file at the Public Data Centre. A customer may, for example, use the centralised information to prepare invoices or to compile periodical reports for management use.

The third public time-sharing computer service offered by NTT, called DEMOS, allows a customer to carry out complex design calculations, for example in civil engineering and operational research. The customer prepares a computer program which is stored in a private computer file at the Public Data Centre, and access to this file is gained from a keyboard printer in the customer's office. Library programs are also available at the Public Data Centre, such as for critical path analysis.

A joint study of a public digital data

Below: The Japanese telecommunications administration NTT offers three time-sharing computer services using the public switched telephone network. This large-scale computer system at NTT's Public Data Centre can be used by customers to carry out complex scientific calculations.

Bottom: A control panel of the DIPS-IL computer system introduced by NTT to improve and expand its data communications services. The system is capable of processing about three times as much information as the largest system previously used by NTT.



network was started in 1971 to plan for future data communication requirements in Japan. Members of the study group are NTT's Electrical Communication Laboratory, the Nippon Electric Company, Hitachi, Oki Electric Industry Company and Fujitsu. The study includes an investigation of the economics of leased line services, circuit switched and packet switched services, as well as leased line services.

North America

In the USA plans for a digital data service based on a private line network have been announced by the American Telephone and Telegraph Company (AT&T), which provides more than 80 per cent of the country's telephones. Depending on approval from the Federal Communications Commission, which regulates all interstate services provided by telephone and telegraph companies, the service is planned for 96 cities, with initial operation between New York and Boston this year.

The Western Union Telegraph Company supplies domestic telegraph services in the USA, and provides a variety of message transmission services, based mainly on its own microwave network with circuit switching and message switching centres. Some of these services are now integrated in the Information Services Communication System (ISCS), which was set up to interconnect the public message service for telegrams and two teleprinter services. By performing any necessary speed or code conversions at a message switching centre, the system enables dissimilar terminals to gain access to each other.

The first ISCS installation was introduced in New York City in 1965 and was based on a single computer centre. Several more installations have since been added, including a large computer switching centre in Middletown, Virginia, which handles more than 50 million messages a year.

To expand its transmission services the Western Union Telegraph Company is constructing an hybrid analogue-digital microwave system. Digital services, provided primarily for voice transmission, will also be suitable for data communication customers. Associated exchange equipment is currently being installed with which it will be possible to offer switched digital data services between terminals and computers.

In 1969 the Federal Communications Commission granted an application to a new company, Microwave Communications Inc, to operate a microwave transmission system between Chicago and St Louis. This was the first stage in the development of a national private line network by the company which will accept analogue or digital inputs. A part of this network is now in service and by the end of the year it is expected to link 81 major cities with a large share of digital data customers. The company provides transmission service between customers by using microwave and radio links in conjunction with leased local lines from AT&T, with whom they are in competition on the trunk routes.

Another American company is developing a national digital data network. The Data Transmission Company submitted applications to the Federal Communications Commission in 1969 for permits to construct 244 microwaves repeaters and terminal stations, intended primarily for the transmission of digital data. Initially a private line digital service is being offered to interconnect customers, with the local lines leased from AT&T. Circuit switching facilities are being planned for the network, and it is expected to encompass 35 major cities when development is completed.

A further field of data network development is packet switching, by which information is transmitted in self-contained blocks, one after the other, at high speed (see Telecommunications Journal, Spring 1973). In the USA this store-and-forward technology has been developed in the research orientated computer network for the Advanced Research Projects Agency (ARPA) of the US Defence Department. The network has been operated since 1970 and enables computers – called "hosts" – and terminals in different areas to communicate with each other by means of common carrier circuits.

At present about 50 "host" computers are connected to the ARPA network by means of small local computers called Interface Message Processors (IMPs). An IMP can rapidly store and forward messages, broken down into packets, to neighbouring IMPs. Traffic on the network is doubling every six months and about four million packets are passing between the IMPs every day.

A number of other firms in the USA have plans to offer packet switching services based on the principles of the ARPA network. Packet Communications Inc intends to provide a service linking 57 cities, and another firm, Telenet Communications Corporation, is planning a similar packet switched network to link 60 major cities.

In Canada the first nationwide commercial digital data network was brought into service in February last year. Called Dataroute, it was introduced by the Trans-Canada Telephone System (TCTS), which is operated by eight of the country's major telephone companies. The network consists of private digital line circuits linking cities from Halifax in the east to Vancouver in the west.

Dataroute is functionally separate from the telephone network, although it shares some of the same physical transmission facilities. TCTS has also recently announced a commercial packet switched service which will utilise transmission facilities derived from Dararoute.

Canadian National/Canadian Pacific Telecommunications, a consortium of the two railway companies which provides telecommunications services, is proposing a digital data network in competition with Dataroute, and it will offer similar facilities to customers.

A push-button telephone (keyphone) is used in Japan to carry out a simple mathematical calculation by means of a time-sharing computer service. The customer keys in an input on her telephone to a computer at NTT's Public Data Centre and receives an audible answer within a few seconds.

THE TROUBLE-SHOOTER

JCE Ramsay

The Post Office operates a fleet of specially-equipped vehicles to investigate complaints by the public of interference to their TV and radio reception. A new prototype vehicle incorporates improvements suggested by operating staff.

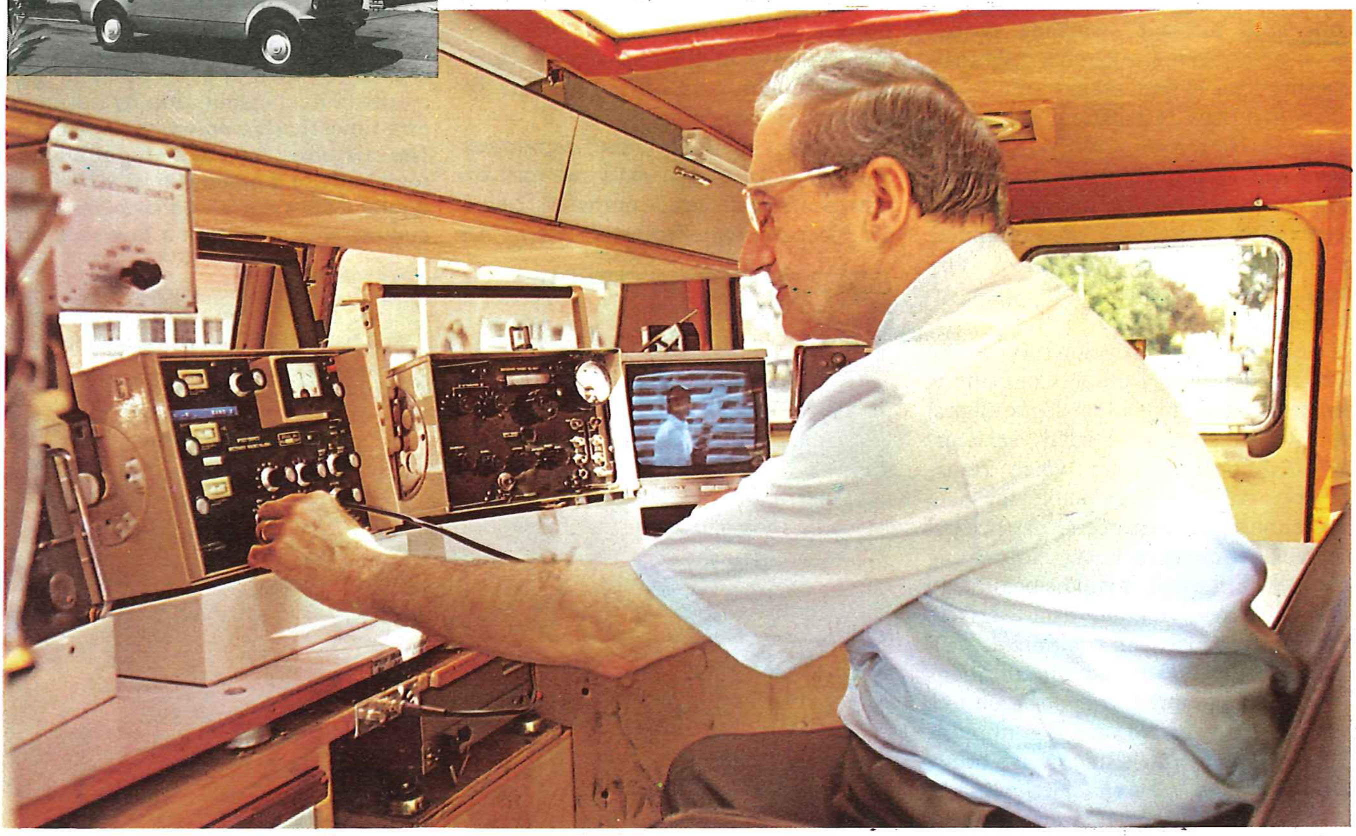
INTERFERENCE to radio and television broadcasting services may be caused to some degree by any appliance or equipment which uses electricity for its operation. Under the Wireless Telegraphy Act 1949 regulations have been introduced to control interference from sources such as the motors used in electrical appliances, refrigerators and the ignition systems in motor vehicles. These regulations require manufacturers or users, as appropriate, to comply with conditions designed to protect radio reception.

Prior to 1969 the Postmaster General was the authority responsible to Parliament for the national control of wireless telegraphy, including the investigation of interference to authorised broadcasting. When the Post Office became a public corporation, headquarters control of this radio interference service was taken over by the Ministry of Posts and Telecommunications (MPT), but in April this year responsibility passed to the Home Office. However, day-to-day operation of the service is still carried out by the Post Office as an agent of the Home Office.

If a member of the public experiences interference to his radio or television reception he can obtain a form from the Post Office to request an investigation. Staff are employed in Telephone Areas throughout the country to investigate complaints, using a fleet of about 275 special vehicles equipped with measuring and tracing equipment. Their task is to identify and locate reported sources of trouble.

Having ascertained that interference is from outside a complainant's premises, the Post Office engineer can often identify the cause by its characteristics. He may then be able to easily pin-point the source if it is in the immediate area,

Left: The prototype vehicle incorporates a pneumatically-operated mast which can be extended to a height of 25 ft. It enables the operator to check television reception without using the complainant's aerial.
Below: In the operating compartment of the new vehicle a test is made to measure the signal strength of a vhf broadcast transmission.



or it may be necessary to use direction-finding techniques if it is more distant. After the source has been located it is his job to inform the owner of the device causing interference, and to offer advice on how to have it suppressed.

For most types of domestic appliance the Post Office can, if requested, install a suitable suppression component for which they make a charge. Alternatively, the owner may have his appliance suppressed either by the manufacturer or a local dealer. If nothing is done to eliminate the cause of the problem, the case will ultimately be referred to the Home Office.

Radio interference staff are provided with 5 cwt vehicles to carry the tools and equipment enabling them to deal with the most common and simplest complaints, such as those caused by domestic appliances. In addition each Telephone Area has a 10 cwt vehicle fitted with test equipment and a 25-ft extending aerial mast to cope with the more complicated interference problems, such as those caused by unwanted signals from radio transmitters, or cases which require the strength of the local television signal to be measured.

The existing fleet of 10 cwt vehicles is nearing the end of its working life and plans have been made for its replacement. At the time these plans were drawn up the MPT was the authority responsible for headquarters control of the radio interference service, including the design of vehicles and equipment. Post Office Telecommunications Headquarters (THQ), which purchases the equipment on behalf of the authority, therefore co-operated with MPT (and, later, the Home Office) in the design and construction of a new prototype vehicle.

Before drawing up a specification for the new vehicle, a questionnaire was circulated to obtain the views of staff operating the existing 10 cwt fleet. Many suggestions by the staff were incorporated in the prototype, which has been shown to and agreed by representatives of the relevant staff association. Purchasing of 74 new vehicles is under way, and it is expected that the first replacements will go into service early in 1975.

Assessment of the questionnaires indicated that a larger vehicle than the existing 10 cwt would be needed, so the prototype has been based on a 15 cwt Bedford body. This will provide more working space for operating staff and allow for the later provision of more up-to-date equipment to measure and locate sources of interference.

Initially it is intended that the equipment used with the present 10 cwt vehicles will be transferred to the replacement fleet. Normally a vehicle will carry test equipment to cover long-wave, medium-wave and very high frequency (VHF) radio, and VHF and ultra high frequency (UHF) television channels.

Portable receiving equipment is used to trace the source of television interference. The operator uses headphones while monitoring the broadcast to avoid causing a nuisance in the street.

A high frequency communications receiver, used in conjunction with a roof-mounted whip aerial and an aerial tuning unit, will also be carried to monitor frequencies used by amateur radio enthusiasts.

A working bench is provided in the operating compartment together with storage facilities for small components, test leads and tools. The bench is fitted on anti-vibration mountings to protect the sensitive electronic equipment when the vehicle is driven on uneven surfaces, perhaps in crossing fields to investigate interference from power lines. Mounting brackets on the bench secure the measuring and tracing receivers, and allow them to be quickly removed for portable use. The operating position in the vehicle body is equipped with a swivel chair and the permanent equipment is arranged in a semi-circle around the operator.

Most of the measuring and tracing equipment is designed to operate from dry batteries or rechargeable cells and is fully portable. For example, the monochrome television receiver can be operated from an associated battery pack, an external 12-volt DC supply or 240 V AC. To avoid creating a nuisance, the operators use headphones to monitor broadcasts or interference with the measuring and tracing receivers outside the vehicle. However, the equipment can be linked to a loudspeaker unit within reach of the operating position when used inside the vehicle. To ensure that each item of equipment can be operated to the limit of its sensitivity within the body compartment, additional suppression has been incorporated to reduce noise from the petrol motive power unit and other items of electrical equipment.

Many complaints of interference to television reception are caused by poorly installed or inadequate aerial systems. A selection of aerials suitable for different localities will be carried so that demonstrations can be given at complainants' premises to show the benefits of correct installation. These aerials can be quickly fitted to a pneumatically-operated mast mounted through the roof of the new vehicle and extended to a height of 25 ft by means of a compressor which is controlled from the operating position.

A transparent panel in the vehicle roof enables the operator to check the direction of an aerial on the mast, which can be rotated to the correct position from the operator's chair. In cases where the vehicle is unable to approach a complainant's premises the mast can be removed, mounted on tripod legs at a suitable point and raised by means of a hand-operated pump.

A second roof-mounted whip aerial is provided at the rear of the new vehicle for use with a land mobile radio transceiver to provide a means of communication between an operator and his headquarters. The transceiver is not being supplied as standard, but if Telephone Areas decide that such communication is required, the equipment can be installed without major modifications to the layout of the operating compartment.

All power supplies in the vehicle are controlled from a distribution panel within easy reach of the operating position. A heavy duty battery which is charged by the vehicle system together with other equipment provides an electronically-generated 240-volt AC supply. This supply is distributed in trunking along the offside to feed standard 13 amp sockets and can be used to recharge the secondary cells of portable equipment as well as to operate domestic appliances which require suppression. In addition, 12 V DC supplies are available from terminal connectors, and can be used to operate the television receiver and any other equipment requiring this form of power supply. A battery condition indicator near the distribution panel and an ammeter on the vehicle dashboard show ▶

the operator the state of the batteries.

An operator may be required to carry out tests of a protracted nature, for example in cases where any one of a large number of machines in a factory is causing interference. Facilities have therefore been provided for an external 240 V AC mains supply to be connected to the vehicle so that operation can be independent of its batteries. A mains cable mounted on a drum and fitted with weatherproof connectors is supplied for this purpose.

Great attention has been given to operator comfort and convenience during production of the prototype vehicle. Fluorescent lighting is fitted in the operating compartment, and the windows have darkened glass to cut down glare from outside and to aid security. Drop-fronted cupboards provide easy access to stored aerials, and there are facilities for storing wet-weather clothing at the rear of the vehicle. A heater working from the engine cooling system heats the operating compartment, and a roof-mounted ventilation fan has also been installed.

Radio interference staff often alternate between the vehicle and a complainant's premises when making tests. Easy access to the vehicle is therefore essential, and a nearside door opening into the operating compartment has been provided, as well as two doors at the rear. A partition with a lockable door separates the driving and operating compartments. Most of the existing 10 cwt radio interference vehicles are operated by one man, and the new vehicle has been designed to the same concept. However, seating is available to carry a passenger for training and similar purposes.

Mr J. C. E. Ramsay is an Executive Engineer in Service Department at Telecommunications Headquarters. He is responsible for liaison with the Home Office and Post Office Regions on all matters connected with radio interference.

PO Telecommunications Journal, Summer 1974

IN MEMORY OF A PIONEER

Born in Italy 100 years ago, Guglielmo Marconi first demonstrated his system of wireless telegraphy in this country in 1896. From the roof of Post Office Headquarters (now Postal Headquarters) in St Martins-le-Grand, London, he successfully transmitted Morse signals to a receiver on a building about 150 yards away.

In one of the events to commemorate the centenary of Marconi's birth his widow, the Marchesa Maria Christina Marconi, and her daughter recently visited the site of the demonstration and were shown the apparatus used. Their visit also marked the co-operation Marconi received from the Post Office when he first came to England to continue his work. In Italy, he had experimented with radio waves as a basis for communication without wires and by the summer of 1895 had succeeded in transmitting signals over a few yards of space. Later that year, using an earth and an elevated aerial at both the transmitter and receiver, he was able to pass Morse code over $1\frac{3}{4}$ miles. When he came to England in 1896 he filed the world's first patent for a system of telegraphy using radio waves.

The apparatus demonstrated by Guglielmo Marconi to Post Office officials in 1896 is inspected by his widow and Mr. Edward Fennessy, Managing Director of Post Office Telecommunications.

Soon after his arrival in this country Marconi met A. A. Campbell Swinton, a well-known electrical engineer, who gave him a letter of introduction to William Preece, Engineer-in-Chief of the General Post Office. Preece was himself experimenting with 'wire-less' telegraphy, but was not using radio waves. On the strength of preliminary demonstrations in the laboratory, Preece invited Marconi to give his first formal demonstration to Post Office officials from the roof of the St Martins-le-Grand building.

Following the success of the first demonstration, Preece asked for further tests at greater range. These took place on Salisbury Plain and good results were obtained at a range of $1\frac{3}{4}$ miles. Although he had achieved success in Italy with elevated aerials, Marconi chose to conduct many of the tests with apparatus in which the transmitting and receiving circuits were each placed at the focus of a parabolic, copper reflector.

Preece, to whom Marconi always acknowledged his indebtedness, gave the young inventor every encouragement and the support of the technical resources of his department. He also gave an historic public lecture on the subject of Marconi's invention in London. During the lecture Marconi moved around the auditorium carrying a receiver with an electric bell which rang whenever Preece, on the platform, pressed the transmitting key.

In the summer of 1897 another successful demonstration was carried out in co-operation with the Post Office. An obvious application for wireless telegraphy lay in bridging stretches of water as an alternative to submarine cables, and it was therefore important to establish that radio waves could in fact be transmitted over water. Preece arranged for tests to be made across the Bristol Channel and they resulted in a record transmission of 8.7 miles.

In 1897 the world's first radio company was formed to develop Marconi's apparatus commercially. One member of the technical staff recruited was George Kemp, assistant in charge of Preece's laboratory, who from the outset of Marconi's association with the Post Office had been detailed to act as his personal assistant.

● An exhibition is currently being held at the Science Museum in London to commemorate the centenary of the birth of Marconi.

Tariffs for international services

AP Hawkins

Countries pay one another for facilities used in providing their international telecommunications services. Payment is made to agreed accounting rates which are a key element in determining charges to customers.

WHEN people in the Post Office talk about tariffs for telecommunications services they normally mean charges to the customer. Charges for inland service are complicated enough in themselves because they are affected by marketing, political, financial and other considerations. Charges to the customer for international service are further complicated by general recognition that large differences in charges for the same service in each direction between two countries should be avoided. Such differences tend to create an unbalanced flow of traffic and also cause difficulty in negotiations between the telecommunications partners providing the service.

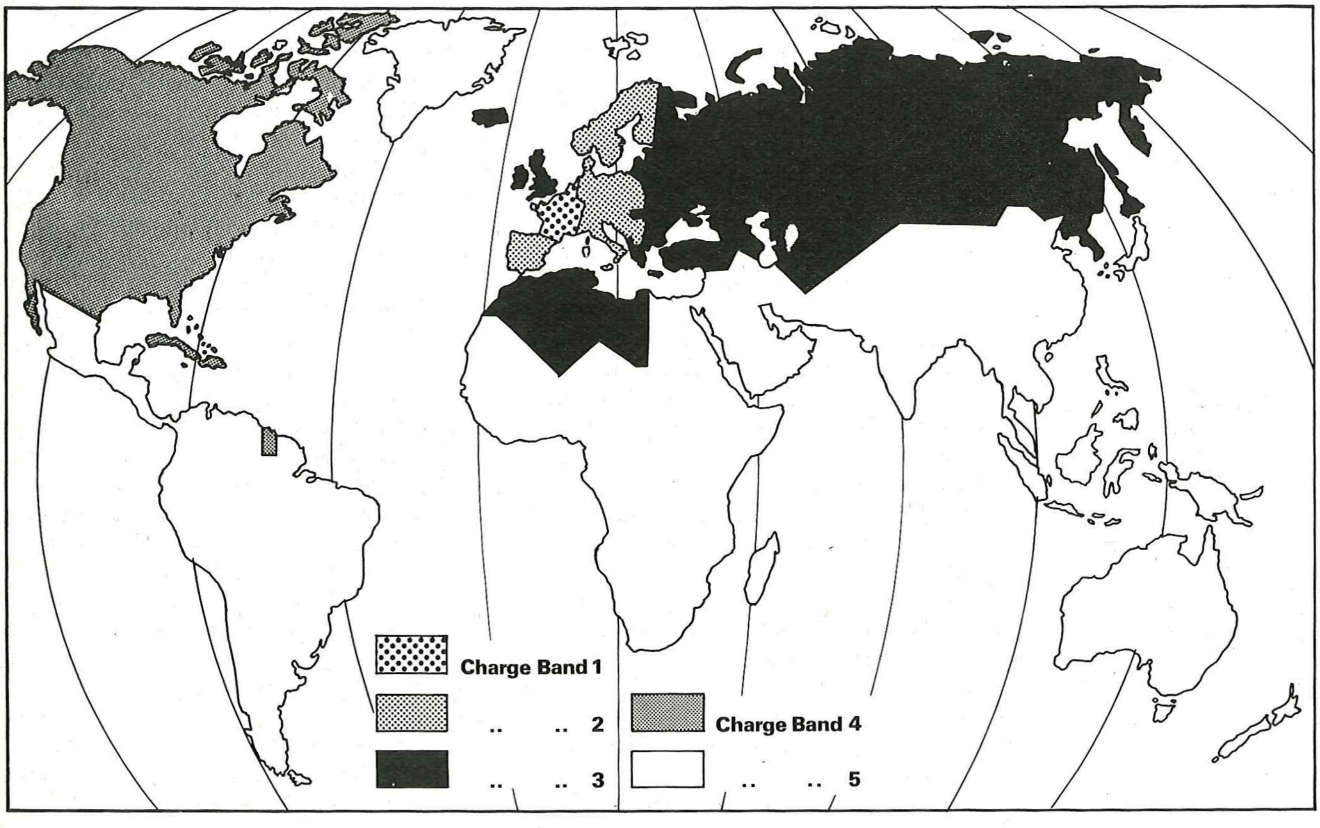
At the same time, the charges for an international service in a particular country have to take account of the method of operation, the charging units used in common with the national service and government fiscal policies. Similarly, to simplify the presentation of charges to customers, it is desirable to have common charges for geographical zones or groups of countries.

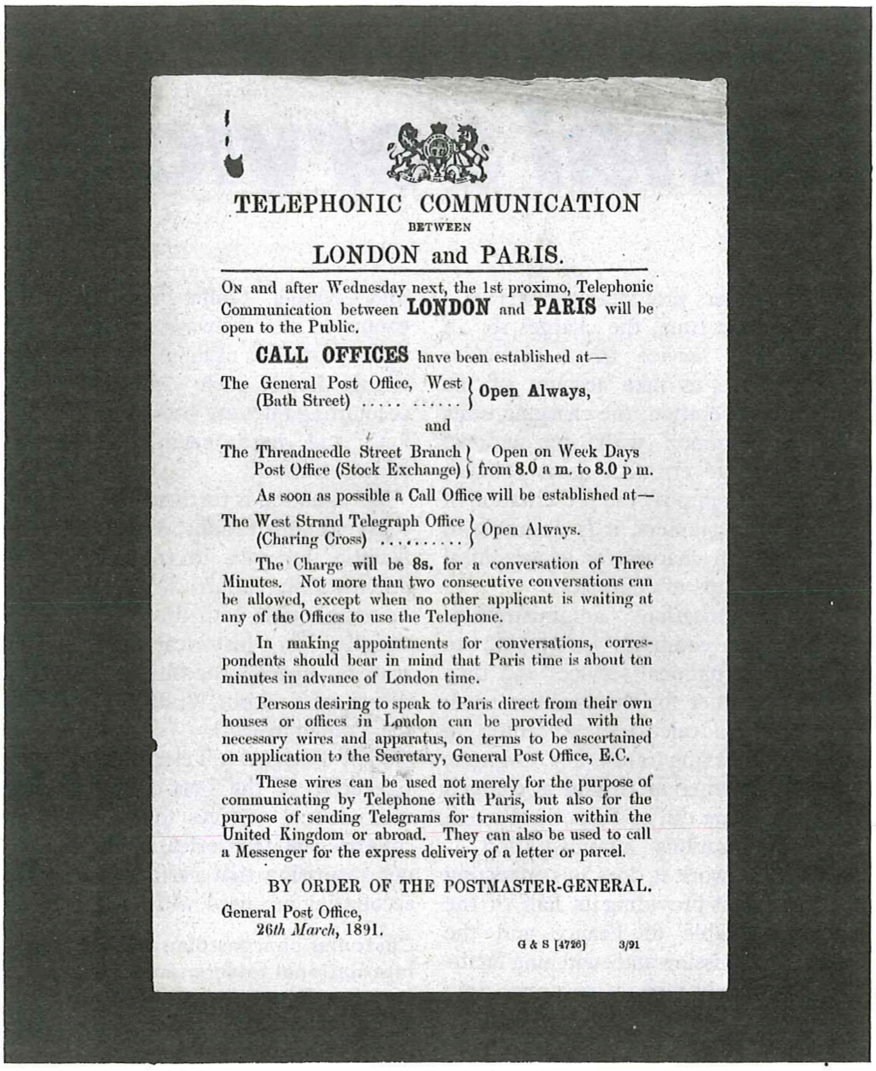
Telecommunications administrations in different countries co-operate to provide international services and they pay one another for the facilities used. Payments are calculated according to agreed accounting rates. For example, when a customer in Britain is charged for a telephone call to Paris the French telecommunications administration is paid for the work it does in connecting the call, that is providing its half of the submarine cable to France and the inland transmission and switching facilities. Conversely when a customer, say, in Paris sends a telex message to Aberdeen, the Post Office expects to receive payment for the work done from mid Channel. Traffic between different countries is not always in balance, and significant sums of money may therefore change hands each year. As a result accounting rates are often the subject of long and hard negotiation between administrations.

The situation is further complicated by some administrations who offer transit facilities for calls in competition with other transit countries, and sometimes in competition with direct links. Additionally, for historical and political reasons special accounting arrangements exist within Western Europe and the Commonwealth.

The External Telecommunications Executive of the Post Office provides international services to more than 200 countries and territories, and it is perhaps not surprising that various methods of accounting are used with other admini- ▶

Customer charges plan for international telecommunications services. In the case of telegrams charge bands 1, 2 and 3 are combined and also include Egypt, Greenland, Lebanon and Syria.





TELEPHONIC COMMUNICATION

BETWEEN

LONDON and PARIS.

On and after Wednesday next, the 1st proximo, Telephonic Communication between **LONDON** and **PARIS** will be open to the Public.

CALL OFFICES have been established at—

The General Post Office, West (Bath Street) .... } **Open Always,**

and

The Threadneedle Street Branch Post Office (Stock Exchange) } Open on Week Days from **8.0** a m. to **8.0** p m.

As soon as possible a Call Office will be established at—

The West Strand Telegraph Office (Charing Cross) .... } Open Always.

The Charge will be **8s.** for a conversation of Three Minutes. Not more than two consecutive conversations can be allowed, except when no other applicant is waiting at any of the Offices to use the Telephone.

In making appointments for conversations, correspondents should bear in mind that Paris time is about ten minutes in advance of London time.

Persons desiring to speak to Paris direct from their own houses or offices in London can be provided with the necessary wires and apparatus, on terms to be ascertained on application to the Secretary, General Post Office, E.C.

These wires can be used not merely for the purpose of communicating by Telephone with Paris, but also for the purpose of sending Telegrams for transmission within the United Kingdom or abroad. They can also be used to call a Messenger for the express delivery of a letter or parcel.

BY ORDER OF THE POSTMASTER-GENERAL.

General Post Office,
26*th March*, 1891.

G & S [4726] 3/91

A notice announcing Britain's first international telephone service for the public. Service is now provided to more than 200 countries.

strations. Nevertheless, recent agreements have enabled a measure of flexibility to be introduced so that it is not necessary to reflect the detailed variations between international accounts in the charges in Britain.

The factors already mentioned are fundamental in determining international tariffs. Other constraints can be identified, if not so readily quantified or kept up-to-date.

In agreeing international accounting rates the Post Office needs to ensure that its costs are covered and that an appropriate return is achieved for the risk involved in providing and operating large capital assets for communications under the sea and in space. Therefore a pre-requisite to negotiation is detailed financial analysis by Telecommunications Finance Department which indicates the cost to the Post Office of the options that may be available.

Cost information is also provided for studies undertaken by the International Telecommunications Union (ITU) to determine the net cost of calls set up on international circuits and for recommending standards to be applied in fixing rates. The ITU is the United Nations specialised agency concerned with fostering international co-operation and promoting development for improving telecommunications services of all kinds. There are currently 140 member countries.

An overseas telephone or telex call is set up using both the international network and the national networks of the terminal countries. Portions of the accounting rate due to each country are derived from three elements of the connection. In Europe, standard rates of payment, based on the recommended ITU standards, are applied to each element.

The first element of the connection is the "line" (transmission) part of the international network, including the various transmission systems used. With the exception of high-frequency radio and satellite links, the accounting rate quota for this "line" part is based on distance. The second element is the international gateway centre – that is, the "switching" part of the international connection plus the terminal transmission equipment. The third element is the "national extension", which denotes that part of the national network of each terminal country involved in completing the call.

The "line" part in a terminal country is usually calculated by taking the distance, in a straight line, between the point where the international circuit crosses the frontier and the international exchange at which the circuit terminates. For services which pass in transit through other countries, the distance in each intermediate country is also measured in a straight line between the frontier points at which the circuit enters and leaves the country. Distances are rounded to the nearest 50 km, and where more than one route is used a weighting is applied according to the number of circuits on each route to determine a length for fixing the accounting rate quota.

There are two methods of paying administrations for the facilities they make available. The first is based on the use made of the facilities and is expressed in minutes of conversation time. Separate accounting rate quotas for the "line" and "switching" elements are recommended for manual, semi-automatic and fully automatic operation under this method to reflect the different loading and costs of the circuits and exchanges.

The first method of payment is being superseded by one based on annual flat rate prices which are paid irrespective of the amount of use, and to date it has been used mainly for remunerating transit countries. With this second method, separate flat rate prices are recommended for the "line" element, depending on whether routing is by individual circuits or by groups or supergroups – lower unit prices being available for the larger scale provision. Flat rate prices for "switching" equipment have also been calculated but are not yet generally applied.

Under both methods of payment the "national extension" charges are fixed by the terminal country after consideration of the volume and distribution of its international traffic in the national network. These charges are subject to specified maximum rates.

In practice, international accounting rates are established through the intermediary of an international monetary unit, which for telecommunications purposes is the Gold Franc, Sterling or the Dollar. Accounts with most administrations are drawn up in terms of the

The control of International Accounting and Traffic Analysis Equipment (IATAE) at Wood Street International Telephone Services Centre in London. Computer-based, it provides information for the analysis of international traffic routing and the settling of costs with overseas operating administrations.

Gold Franc, which is 90 per cent pure gold and weighs 10/31 of a gramme. As a result, the day-to-day value of Sterling in world markets determines how much the Post Office pays and receives in settling the balance of accounts. Any substantial change in the value of Sterling affects the business, and trends in the floating Pound have to be watched to determine whether action is necessary to amend tariffs. However, it would be impracticable to reflect the shorter-term monetary variations in the charges to customers in this country.

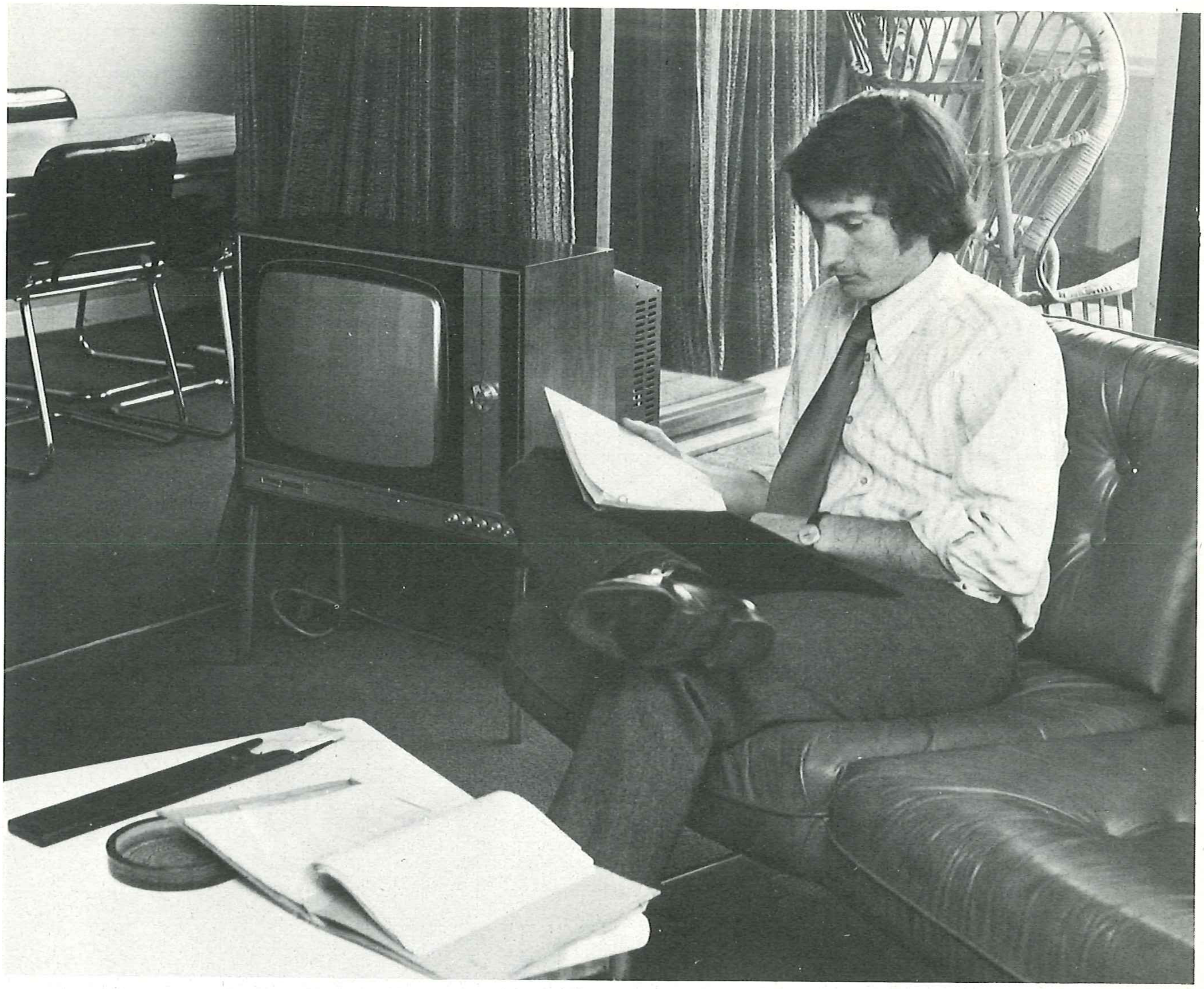
It is evident that the processes of setting international accounting rates are complex. In the past customer charges have been arrived at as new services have been introduced and as additional countries have been served. The pattern thus established was characterised by variations from country to country and was contrary to reasonable marketing principles. In addition, it was difficult to rationalise the charge structure in a period of relative price stability.

More recently radical changes have been made in the services, stemming notably from the availability of international subscriber dialling both for telephone and telex, and of high-quality intercontinental transmission by undersea cable and satellite. These changes have been accompanied by a growth in traffic, which has been doubling every four years or so, and considerable pressure to meet demand.

Marketing and customer charge activity has therefore tended to be subdued and restricted to the minimum necessary to inform customers and accommodate changed circumstances. Now, with large new international exchanges approaching completion, adequate switching capacity will become available. Accordingly, action has been taken to simplify customer charge structures which goes a long way to introducing three bands of charges for European services and two bands for intercontinental services.

This process of simplifying charges will be completed soon when further changes are made, including the introduction of cheap rates at off-peak periods for subscriber dialled telephone calls. Although charges will not be directly related to the money the Post Office pays out, customers in Britain will then have a simple, straightforward charge structure which is fully competitive with other countries.

Mr A. P. Hawkins is head of the Service Policy and Tariffs Division in the External Telecommunications Executive of the Post Office.



Stay-at-home students

A Perkins

At home: Technical Officer Roy Hookway works on a Post Office correspondence course. He is currently doing fourth-year studies in mathematics, telephony and telecommunications principles with the aim of gaining a City and Guilds Final Certificate.

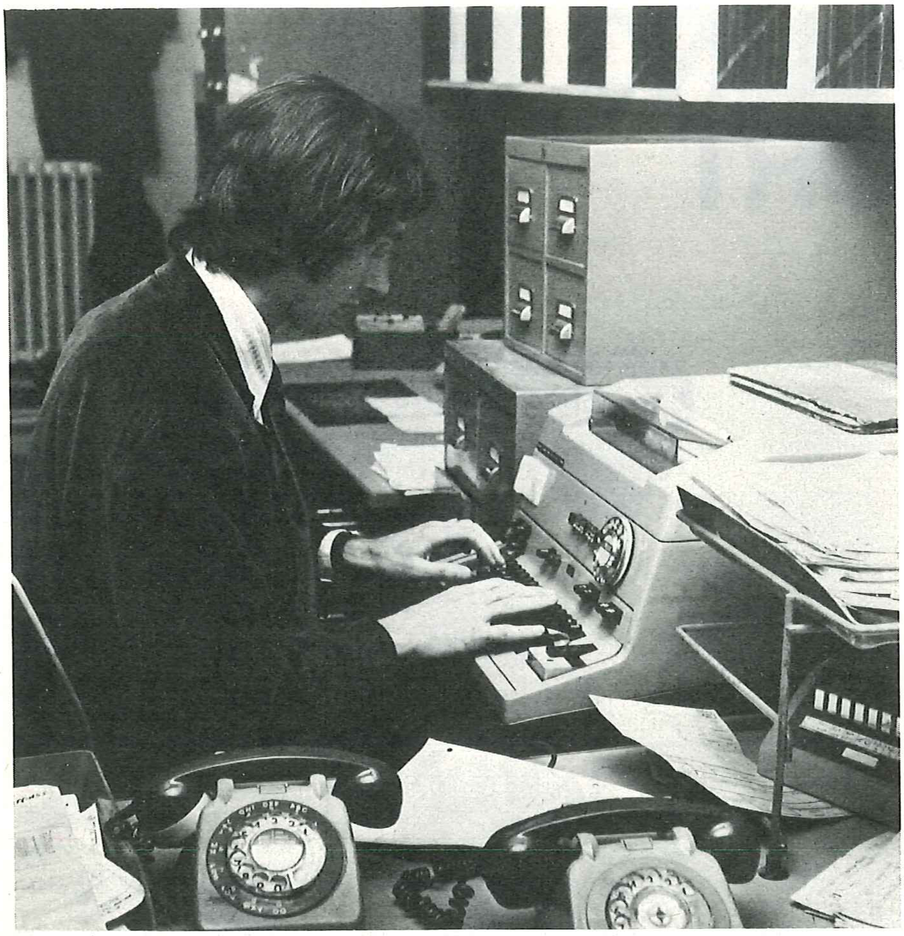
A technical education scheme created through war-time necessity still operates successfully in the Post Office today. Consisting of correspondence courses, it enables technicians to study at home to widen their knowledge of telecommunications. A new method of running the scheme is now being tried to encourage more students to complete their courses.

SINCE THE beginning of this century Post Office staff have been encouraged to study technical subjects to complement the training given as part of their work. The National Telephone Company, which managed the telephone system in this country up to 1911, provided correspondence courses for its technical staff. When the Post Office took over the scheme was discontinued through lack of Treasury support.

The Treasury later gave permission for a correspondence scheme to be reintroduced, based on the City and Guilds Telecommunication Technicians' syllabus. These courses, written and tutored by full-time staff, first appeared in 1931 and increased in popularity until they had to be abandoned at the outbreak of the last war. By 1943, the lack of technical education facilities gave cause for concern and a war-time scheme was launched. It made use of existing course material and staff were appointed to act as tutors outside working hours.

After the war full-time authors were again employed to update the material, but part-time tutoring was retained. This method was so successful that it has continued with only minor changes. The number of students enrolled and the total courses taken reached a peak in the immediate post-war years, and has since been slowly declining owing to improved technical college facilities. However, about 2,400 students are currently taking 3,000 courses.

Subjects range from practical mathematics, engineering science and elementary telecommunications practice, to



At work: Roy carries out duties at a circuit provision control in the North Central Telephone Area, London.

advanced telecommunications principles, switching principles and advanced telephony. They include various courses on telephony, telegraphy, line plant practice, radio and line transmission.

Throughout its history the scheme has suffered from one major failing. Many students who enrol for a course drop out after doing only a few lessons. At present 66 per cent do not complete their courses, although about 80 per cent of those who do finish pass the examination. Various ideas have been tried to overcome the problem. The number of lessons in a course has been reduced from 15 to 14, unnecessary material has been pruned from lessons and students have been allowed to enrol for one subject at a time instead of two or three as originally intended.

In another attempt to reduce the number of students who fail to complete their course, a new method of running the scheme is being tried. Formerly, lessons were sent fortnightly to the student, who submitted his homework to the tutor as the next lesson arrived. If the student did not follow this rigid timetable without a good reason he was fined a nominal sum and received no more lessons. With the new trial arrangement a student is supplied with the first three lessons when he enrols for a course. He studies the first of these lessons, completes his homework and submits it to his tutor. Corrected homework is returned to the student together with his fourth lesson. This system continues until the course is completed. The student is no longer bound by a rigid timetable and he can submit the homework at any time provided he does not exceed two years for the course.

It is hoped that the new scheme will reduce the number of students who fail to complete a course, since the extended period for study will allow breaks for illness, holidays, and so forth. If a student fails to complete a course he will be fined according to the number of homeworks outstanding, but he will receive the remaining lessons so that he may continue his studies privately.

Students taking fifth-year subjects are usually more mature, and the advanced courses take this into consideration. Tutors are not provided as for the earlier years, but the lessons contain self-assessment questions. In the event of difficulty the student contacts the author of the course.

The first five lessons for advanced courses are sent on enrolment, together with a test paper which must be completed within three months. If the result of the test is satisfactory the next five lessons and a further test paper are sent to the student. The same procedure is followed for the final four lessons. A student is liable to be fined if he does not make a satisfactory attempt at the two test papers.

Does the Post Office get value for money from this scheme? The 3,000 courses currently issued cost the Post Office about £100,000 a year, for which it can expect to get 800 examination successes. To obtain the same successes from evening classes would cost much less, and from day-release classes much more. However, many of the correspondence students would not be granted day-release and could not attend evening classes because of the travel involved, rota duties at work or the non-availability of classes. Others cannot attend college for domestic reasons. So the correspondence courses are an essential part of the overall scheme of technical education.

Most engineering staff in Post Office Telecommunications have probably at some time taken, considered undertaking or referred to one of these courses. No doubt they have also formed an opinion of their worth, but perhaps the best indication of the value of these courses is given by their wide use outside the Post Office. They are used as references by technical colleges, overseas training schools and administrations throughout the English speaking world. In 1973 material for 2,000 courses was printed to meet this demand, and when these outside interests have seen one course they invariably ask for more.

Looking to the future, the Technician Education Council will soon be drawing up new syllabuses. When they are introduced, probably in 1976, the existing City and Guilds Technicians' courses will be phased out. The form of the new syllabuses has not yet been decided, but the Council has stated that the needs of the external student who is not attending a college – for example, a correspondence student – will have to be taken into account. This will undoubtedly involve a large-scale revision of Post Office correspondence courses, and it may even be necessary to include some practical work and a period at a teaching centre as is required by the Open University.

Mr A. Perkins is an Executive Engineer in Telecommunications Personnel Department responsible for liaising with technical colleges. He was formerly an editor for some of the Post Office correspondence courses.

PO Telecommunications Journal, Summer 1974

CONTROLLING THE R&D EFFORT

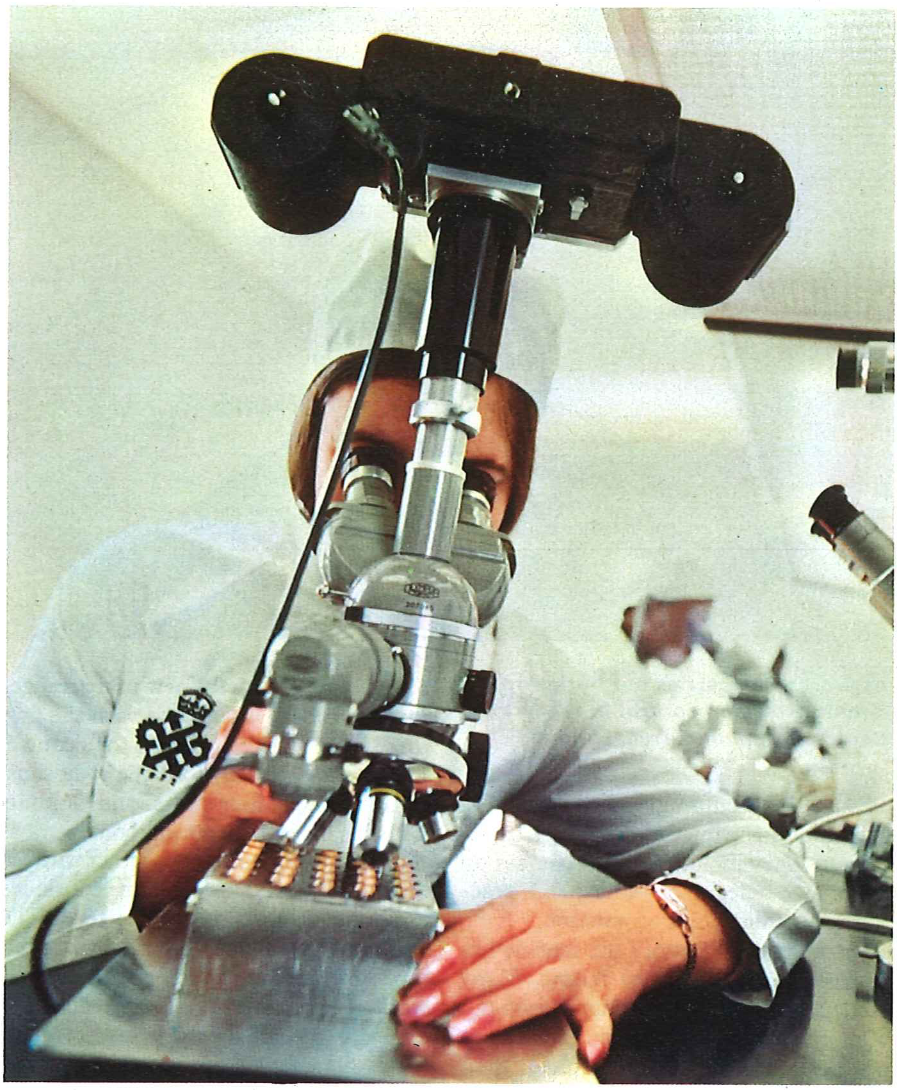
VJ Kyte

CONTINUING research and development is essential to maintain, improve and expand Britain's telecommunications services. The Telecommunications Business of the Post Office needs work to be carried out to sustain and improve current systems, to develop new systems and to explore ideas for the future, and its research and development departments employ more than 3,000 people. They have on hand about 4,000 separate tasks, which are organised into 400 projects.

When R&D is carried out on this large scale, formal processes of control are needed to ensure that the work contributes effectively and economically to the viability of the business as a whole. Its aims must be aligned with those of the business and the costs must be acceptable to the business. The system of organisation and control of R&D work employed by Post Office Telecommunications was established in 1969 as the result of a report by a firm of management consultants. The system, which is operated by the Development Planning Division in the Telecommunications Systems Strategy Department, is continuously under review and has been developing each year.

The main aims of R&D are to provide technological support to the objectives and plans of the business, and to advise on emerging technological possibilities which may influence future objectives and strategies. This requires a link between business planning and R&D planning. The link has only recently been forged, which indicates that the R&D management system is still evolving. Current aims are to strengthen the links with the operational side of the telecommunications business, and to use the information about future trends as an aid to R&D manpower planning.

If no constraints were imposed, manpower growth to meet demand in the R&D departments would be about 15–20 per cent each year. However, constraints do exist. Limits are placed by the Post Office Board on the overall budget, which for 1974–75 will be about £28 million. Staffing problems provide a variety of constraints, such as accommodation shortages, lack of suitable skills, and the need to achieve a balance between new and experienced staff. The balance between the long-term and short-term needs of the business also affects the timing and direction of R&D work.



Transistors used in the repeaters of the recently inaugurated transatlantic submarine cable, CANTAT 2, have a design life of at least 25 years. They were developed and produced by the Post Office, an achievement which won a Queen's Award to Industry for the Research Department.

Over and above these constraints is the national economic environment. For example, in circumstances when the Post Office may be anxious to increase R&D it may be held back by difficulties in placing work out to contract, or problems may arise in dovetailing strategic plans with those of industry.

Even if no constraints existed, the need to try to ensure that the business and R&D itself was getting value for money would remain. In many cases the value of projects cannot be quantified. There are economic benefits which have a direct financial effect on the business, either by increasing income or by reducing outgoings. Examples are the development of radio paging facilities which provide additional revenue, and a new design of residential telephone which is cheaper to make. Other benefits do not lend themselves readily to expression in financial or other numerate terms and are referred to as non-economic benefits. Examples are the

A Post Office research engineer in the transmission standards laboratory at Dollis Hill carries out sensitivity measurements on a telephone handset microphone. He is using a recently developed instrument which simulates speech, and measurements are processed by the computer seen in the background.

acquisition of knowledge and expertise, and maintaining or improving the quality of service.

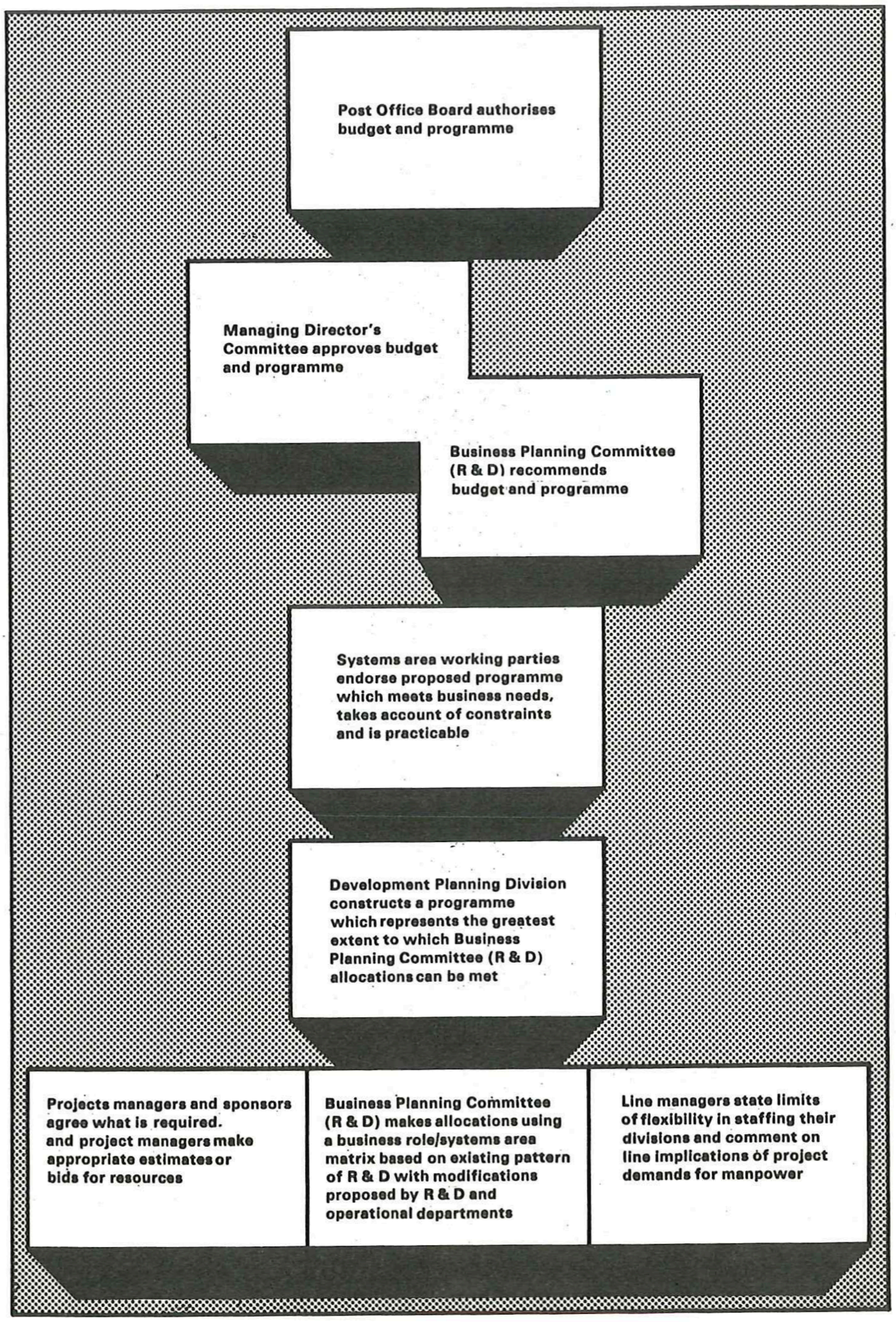
Comparison of the worth of projects is bedevilled by the absence of scales for comparing attributes. For the time being, reliance is placed on the individual and collective judgments of Directors in the business to determine the relative priority of projects.

In the event, it is not only the constraints already mentioned which determine the pattern of R&D, but the practical problem that the work to be done and the skills of the staff available may overlap, but do not coincide. The nature of the work ranges from basic research, with possible long-term applications, to work in direct support of the day-to-day work of operational departments. The size ranges from individual tasks, involving a few hours' work, to major projects costing several million pounds over a number of years. In this situation it is helpful to be able to identify projects where an element of flexibility exists in timing and in the amount of effort required, and to ensure that manpower growth occurs only in those areas where a continuing need is foreseen.

Within the constraints set by an acceptable level of expenditure and the skills and resources available, the R&D management system endeavours to maximise the benefits to the business and to achieve an acceptable balance between the long and short term needs and the various systems and services involved.

The operational and R&D departments get together each year to decide on the programme of work which can be carried out and which best meets the needs of the business. The procedure for constructing the programme is subjected to close review each year to remedy any deficiencies or difficulties encountered, to build on the knowledge and expertise gained by participants in the preceding year and to prepare the groundwork for further developments.

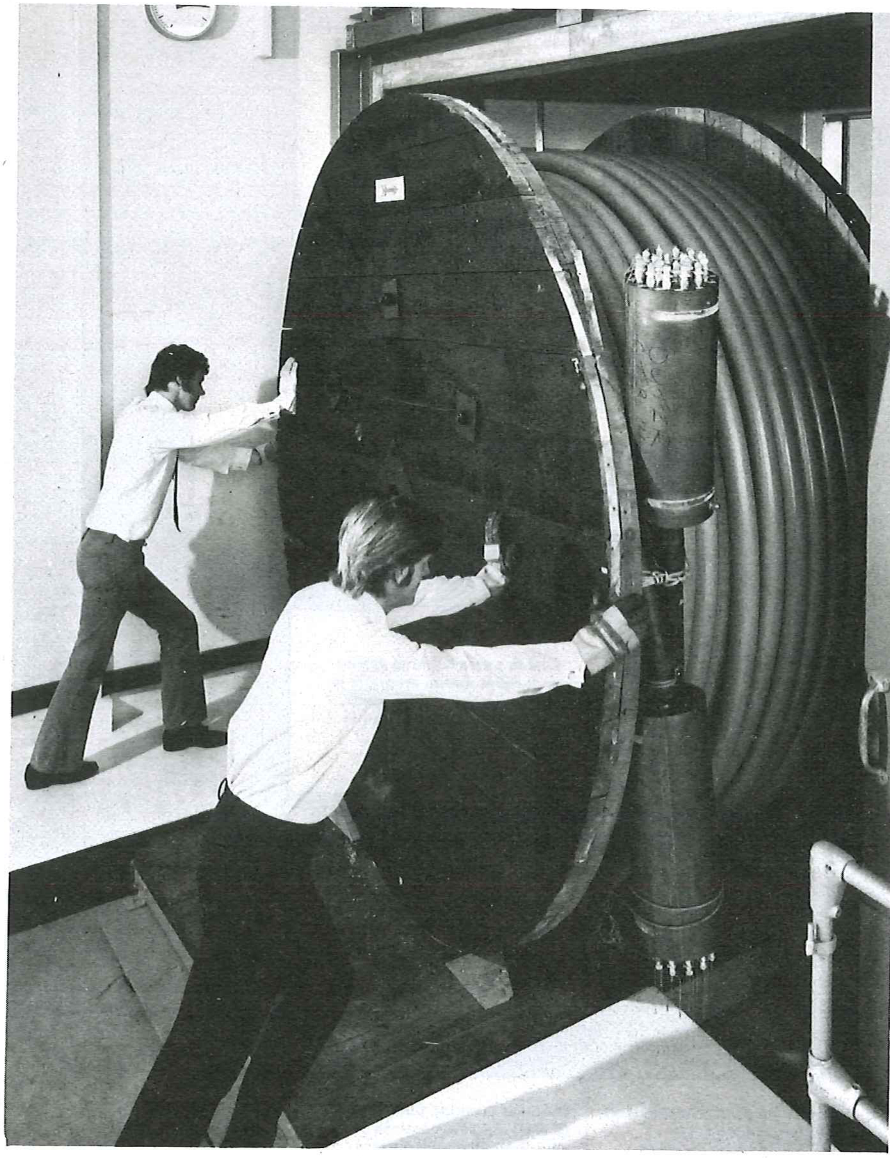
Several new features are being introduced in the construction of the 1975–76 programme. For the first time R&D and operational departments will have an opportunity to influence the planning matrix proposed to the Business Planning Committee (R&D), which determines the overall size and balance of the programme. This will enable the departments to study the distribution of priority of projects within and between system areas – switching and signalling, inland transmission, and so forth – and to agree project classifications. These will then remain unchanged throughout the construction and execution of the 1975–76 programme.



How the Post Office Telecommunications R&D programme is built up.

Line managers (heads of divisions in R&D departments) will for the first time be given the opportunity to comment on the line implications of project demands before a programme is constructed. They will also be able to specify the upper and lower staffing limits achievable for their divisions. This will enable the Development Planning Division to ensure that the divisional manpower allocations emerging from the programming process will fall within the limits.

Each year it is necessary for project managers to estimate the manhours,



A drum of 18-pair coaxial cable enters a chamber at the Post Office Research Centre, Martlesham, to undergo performance tests in strictly controlled temperatures. The drum, weighing about six tons, can be easily moved into and out of the chamber on a hover platform operated by compressed air.

materials, cost of contract work, computing expenses, and so forth, required to carry out work on their project. This is comparatively easy in the case of projects where an identifiable achievement by a set time can be specified.

Assessing the sources required is much more difficult in the case of projects where the R&D effort is needed to support, as and when required, the introduction of new equipment or services in the field. For the 1975–76 programme, project managers will be able to opt to prepare estimates geared to a known target and date. Alternatively they can have the previous year's outturn as the budget for the programme year, as well as the opportunity to make a bid for increased or decreased resources. This should save estimating time while still catering for changes in the nature of work on individual projects.

The changes in procedure will involve some people in more work, but both operational and R&D departmental representatives feel that this is necessary if programming is to be soundly based. The effort spent on programming is justified only if participation is real and not nominal, if there is a commitment to the policy and if the outcome in the form of project and line budgets is not treated as a matter of academic interest. It follows that means must be found or strengthened for both R&D and the operational departments to ensure that they derive the maximum benefit from the process, and further developments are therefore planned.

The worth of a project is diminished if costs or time exceed the forecast, and this may have repercussions on the plans of operational departments. The control system relies on information provided by computer print-outs, which are part of the R&D management accounting system. Management accounting differs from financial accounting by aiming to provide managers with information to guide their actions in controlling work rather than to establish the financial state of business.

Although means do exist to compare budget with expenditure, this is of limited value unless information is also available about the progress of work. Where such information is readily available, no further steps are required. Where it is not, means are being provided to ensure that those with an interest in the outcome of the work can obtain it.

New work presents a problem, and in the pressure to get work done the expenditure incurred may be allocated to an existing project with little attention to the effect this may have on other work of equal importance. The procedure is therefore being changed so that no delay occurs in allocating such work its own project number at the outset and so that the effect of diverting resources to it can be identified at an early stage.

Much of the value of carefully planned and costed work is lost unless the results are speedily implemented. At present there is no quick way of identifying projects where the work is ready for operational departments. In future project managers and sponsors will be asked to state this date rather than a "completion date", which is open to many interpretations.

The sponsor of a project is the nominated representative of the department which instigated the work or is the potential major user of its outcome, and he stands in relation to the project manager as a client does to an architect. Together they ensure that the work will meet the sponsor's need, and each keeps the other informed of any unexpected developments either in the work or in the ends it is to serve which may affect future plans.

Progress on improvements can only be achieved at the rate at which they are accepted by operational and R&D departments. The large number of improvements to be implemented this year is a measure of the help and co-operation given by operational and R&D departments to the Telecommunications Systems Strategy Department.

Miss V. J. Kyte is head of a section in the Telecommunications Systems Strategy Department in charge of administration of the research and development management control system.

PO Telecommunications Journal, Summer 1974

MISCELLANY

Speedier service

Britain's third international telephone control centre has opened in Glasgow as part of a £1 million Post Office scheme to provide a speedier service for people making international calls connected by the operator. The new centre will eventually handle international calls from customers in Scotland, Northern Ireland and the North of England.

International telephone control centres are being provided to simplify and speed up operator-connected international calls from places outside London. Centres are already working in Brighton, serving the South-East of England, and Leicester, covering the Midlands and East Anglia.

Before the opening of control centres outside London, every one of the 10 million operator-connected international calls made each year had to be made through the international exchange in London. For callers outside London this meant dialling the capital, booking the call and then hanging up to wait for the London operator to ring back when the call was set up. Now, people in areas served by the new centres have many of their calls connected on demand, simply by dialling their local international control centre.

More weather news

Three new weather-forecast services by telephone have been introduced experimentally by the Post Office. Giving forecasts updated by the Meteorological Office three times a day – more often if sudden changes are anticipated – the new trial services cover larger areas than the forecasts which they replace.

The idea is to enlarge the areas covered by weather services so that forecasts will be of value to many more people. The areas covered by the trial are Devon and Cornwall, the whole of North-East England, Lancashire, Cheshire, and the new metropolitan counties of Merseyside and Greater Manchester.

During the trial the Post Office will evaluate public reaction and if there is sufficient demand, the scheme will be extended nationwide, with most of the UK covered by 26 forecasts.

Cable cuts

Five major submarine telephone cables and a telegraph cable linking Britain with Northern Europe are being cut and joined up again this summer to make way for a North Sea gas pipeline. But there will be no interruption to international communications.

In a massive recovery and repair exercise six cableships are being used so that Phillips Petroleum can lay and bury a gas pipeline between the Ekofisk field 200 miles off Scotland, and Emden in Germany. The pipeline route, running North to South, crosses the cables, most of which are in the southern North Sea.

The cables, which between them carry more than 3,000 telephone circuits, form a vital communication network carrying telephone calls, telegrams, telex messages, computer data and some radio broadcasts between Britain and 15 other countries. Six telecommunication authorities, Britain, Germany, Norway, Denmark, Sweden and the Netherlands, together with the Great Northern Telegraph Co, have joined forces in a major planning task to ensure that telecommunications services are not interrupted.

Each cable is being lifted, then relaid over the pipeline once this has been buried beneath the sea bed. Before each cable is cut, telephone calls and other communications will be switched to the other cables.

Shoppers' aid

A new telephone information service providing food price news has been launched in London by the Post Office. Information is provided by the Department of Prices and Consumer Protection to give shoppers price trends for fresh food, including meat, poultry, eggs, fish, fruit and vegetables.

The service is updated every Thursday afternoon as a weekend shopping guide. If the pilot scheme in London is successful the Post Office and the Department of Prices and Consumer Protection will consider extending this service to other parts of the country.

The Post Office has already been successfully running a dial-a-dish Recipe Service for 13 years. Receiving more than three million calls a year, it now features inexpensive recipes designed to provide main course dishes for four at no more than 75p. All recipes, provided by the British Farm Produce Council, have been tested in ordinary kitchens and are simple to make. The Recipe Service is available from 53 different centres throughout the United Kingdom.

Calling China

Telephone service with the People's Republic of China, which had been available for only three hours a day, became full-time following the opening in China of a satellite earth station using the INTELSAT-IV communications satellite positioned 22,300 miles above the Indian Ocean. Telephone calls from Britain to China are now beamed from the Post Office satellite earth station at Goonhilly Downs, Cornwall, and received by China's new earth station, near Peking.

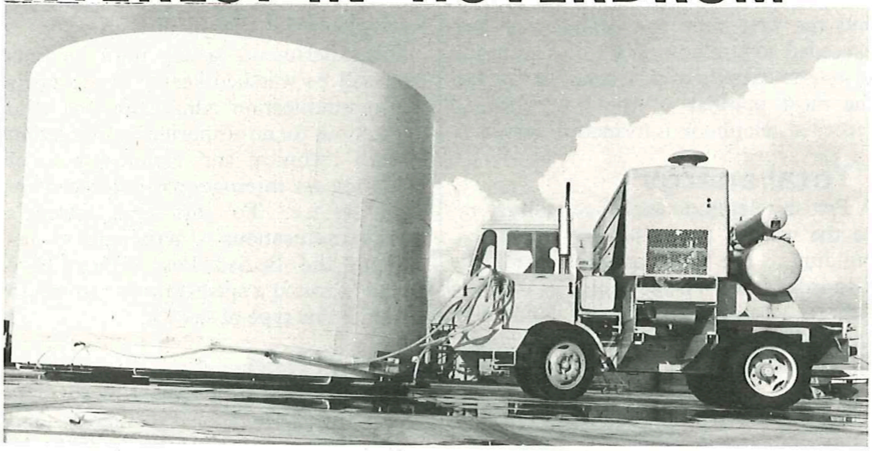
The satellite link replaces a high-frequency radio route. Clarity of speech is much greater, while continuity of communications – always difficult to maintain on high-frequency radio, which can be affected by weather conditions – is greatly improved. The satellite link consists of one telephone circuit but can be readily increased to three if there is sufficient demand.

Petrol saved

More than three million gallons of petrol have been saved over the past 10 years by Post Office Telecommunications, which has more than 50,000 vehicles on the road. These savings have been achieved by a policy of restricting engine power output on the smaller vehicles which form the backbone of the fleet.

The Telecommunications Business is Britain's biggest commercial vehicle

INTEREST IN 'HOVERDRUM'



Authorities in the USA, France, Belgium and Spain have asked for full details of a Post Office application of the hovercraft principle for moving 70-ton loads of submarine telephone cable. The technique uses four small hover platforms to lift 18-ft diameter pans loaded with cable. Air-flow to the platforms is provided by a compressor tug which manoeuvres the pans by pushing or towing once they are floating on a cushion of air. Successful trials of the technique have been carried out at the Post Office's new cableship depot at Southampton, where it will be used to move pans about the dockside at about a tenth of the cost, yet with much greater mobility, than a mobile crane on rails (see Telecommunications Journal, Spring 1973).

operator, and uses fuel consumption as one of the primary tests when purchasing new vehicles. A detailed evaluation by the motor transport division shows that the policy of restricting engine power output saved a total of 3,200,000 gallons of petrol, worth more than £1 million, between 1963 and 1973.

If manufacturers' standard vehicles had been used in the 5 cwt to 7 cwt range, fuel consumption in this class of vehicle would have been 32.2 million gallons. As a result of the action to reduce fuel consumption only 29 million gallons were used. Vehicle performance, particularly acceleration and top speed, is normally controlled by fitting carburettors which restrict the petrol-flow to the engine.

Driving trophy

The best Post Office driver in the national Lorry Driver of the Year (LDOY) competition will in future receive a new trophy presented by the corporation's Chairman, Sir William Ryland. The "Ryland Trophy" will be first awarded in the 1974 finals, at Bramcote, Warwickshire, on 8 September.

The Post Office already makes financial awards to its drivers reaching the national final and those placed first, second or third in a vehicle class in the final. A Post Office man who becomes Lorry Driver of the Year receives a further £100, while those placed second or third in the Grand LDOY final receive £50. Special awards are made to the best drivers from the Postal and Telecommunications businesses.

400 million times

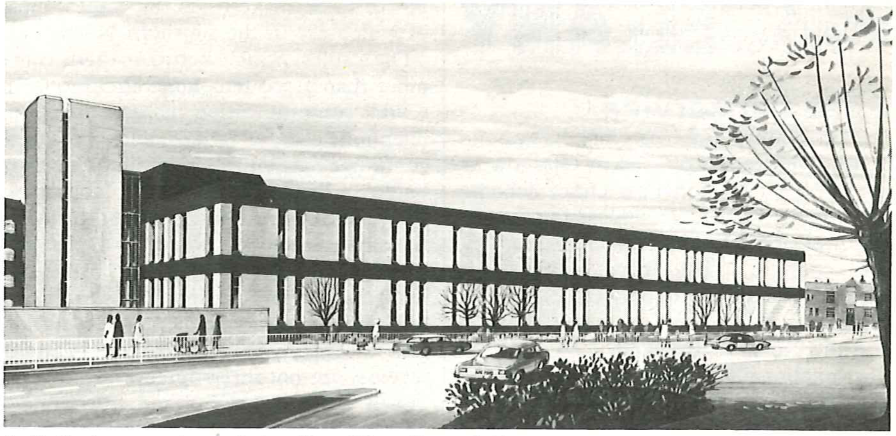
Telephone calls to the Speaking Clock are reaching new record levels. During the year ended 31 March, the service received a total of 405 million calls – nearly 38 million more than in 1972-73 and the first time the calling rate has exceeded 400 million. The clock, accurate to one-twentieth of a second, is by far the most popular of the Post Office's recorded telephone information services.

"Total energy"

A British telephone exchange is likely to be the world's first telecommunications building to use "total energy". Mr P. J. Edwards, Chief Power Engineer of Post Office Telecommunications, told the annual luncheon of the Diesel Engineers and Users Association that a large new telephone centre in Cardiff is to use diesel engines to meet all its energy needs.

The engines will generate electricity for operating the exchange equipment, for lighting, for lifts, for water pumping and for office machinery. Waste heat from the engines will be used for the hot water, for heating the building in winter and for cooling it in summer.

Mr Edwards told the Association that this was only one example of new uses for engine-generator sets now being planned by the Post Office. Another was



Artist's impression of the £1 million Post Office telecommunications centre being constructed at Town Head on the north side of Rochdale. The two-storey building will house an automatic trunk exchange to help the flow of calls to and from 10 exchanges in the Rochdale area serving more than 45,000 customers, and will cater for expansion for the next 10 years.

the intention to provide by continuous generation a precise and stable electricity supply to power the Post Office's satellite communications earth station on Goonhilly Downs, Cornwall.

The Post Office had its eyes open for new opportunities in other fields, eg, fuel cells and sodium sulphur batteries.

European trial

Britain's Confravision service – the video-conference network for businessmen – has been extended into Europe for the first time, on a trial basis.

Four countries – France, Belgium, Germany and Denmark – are co-operating in the experiment between the UK and Sweden by providing lines through their territory to carry the pictures. The Netherlands, now in the process of building and equipping a video-conference studio, hopes to operate an experimental link with Britain and Sweden as soon as the studio is ready, later this year or early in 1975.

The experiment, lasting until December, will be watched keenly by Europe's telecommunication administrations who are anxious for an authoritative evaluation – both technical and commercial – of operating an international video-conference service. To this end Europe's telecommunications authorities, including the British Post Office, have already formed a special project group to examine this type of service.

Into office

Professor J. H. H. Merriman, Post Office Board Member for Technology and Senior Director Development, will take office as President of the Institution of Electrical Engineers on 1 October.

Computer goes live

Live work has begun on the powerful IBM 370/168 computer purchased by the Post Office to provide a nationwide problem-solving service for staff who need ready access to computers in their day-to-day work (see Telecommunications Journal, Spring 1974). One of the machine's main areas of operation is in providing facilities to support research and development of new telephone systems. It will be used in computer-based studies simulating the traffic passing through telephone networks.

Operated by staff of the Post Office Data Processing Service (DPS), the IBM is taking over the work of five existing computers. It is six times more powerful than the machines it is replacing and will also handle work that the Post Office previously placed with commercial bureaux. To transfer work from existing machines and to convert to new computer disciplines not previously used in the DPS has involved a major operation which has been completed within only six months from the decision to purchase the new machine.

Contracts

GEC Telecommunications Ltd—More than £½ million for private telephone exchange equipment. The orders cover private automatic branch exchanges which will be installed in various Government Departments including the Welsh Office in Cardiff, the Land Registry Office in London, and the Department of the Environment in Birmingham. The orders also include selectors and receivers for PABX switching, and long-distance signalling equipment.

Standard Telephones and Cables Ltd—Most of the TAT 6 cable running from the west coast of France 3,600 nautical miles across the Atlantic to Rhode Island, USA. The cable will provide 4,000 additional telephone circuits between Europe and the USA, and will use a new type of cable developed in conjunction with the Post Office and the American Telephone & Telegraph Co.

Standard Telephones and Cables Ltd—More than £1 million for data modems. A total of 1,400 standard modems has been ordered and they will be used in conjunction with the Datel 2400 and Datel 2400 Dial Up services.

Publication and Price:
The Journal is published in January, April, July and October, price 12p per issue. The annual postal subscription is 80p – reduced to 48p for retired staff.

Contributions:
The Editorial Board will be glad to consider articles of general interest in the telecommunications field. No guarantee of publication can be given. The ideal length of such articles is between 1,000 and 2,000 words. The views of contributors are not necessarily those of the Board or of the Post Office.

Correspondence:
Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Post Office Central Headquarters, 23 Howland St., LONDON W1P 6HQ. Telephone: 01-631 2191 (editorial), 2193 (sales). Remittances should be made payable to "The Post Office" and should be crossed "& Co.". The Giro account number is 535-1006.

Get your **Telecommunications Journal** regularly

Complete the form or photocopy and send to
TELECOMMUNICATIONS JOURNAL
Public Relations Department,
Post Office Central Headquarters,
23 Howland St., LONDON, W1P 6HQ.

(If you do not work for the Post Office send your subscription to the same address. Details of the annual postal subscription are given above.)

I wish to subscribe to the Post Office Telecommunications Journal and authorise deduction of the subscription from my salary or wages. (Four issues a year at 12p per issue.)

Name____________________ Grade__________

Signature____________________ Date__________

Duty Reference____________________ Pay Group__________

Office Address______________________________

DIGIWATT WATTMETER

DIGIWATT' is the term applied to a new range of Wattmeters which display their readings in digital form. They combine the accuracy of electrical measurements with the speed and convenience of electronic readout.

The instrument incorporates a newly developed Wattmetric Transducer which works as a quarter square multiplier and responds to signals of almost any waveshape over a wide range of frequencies. The method of construction of the transducer is subject to patent applications.

The transducer is coupled to the circuit under test by carefully designed transformers which produce a very low burden on the circuit.

The instrument has the advantage of having no moving parts to wear and will operate in any physical position.

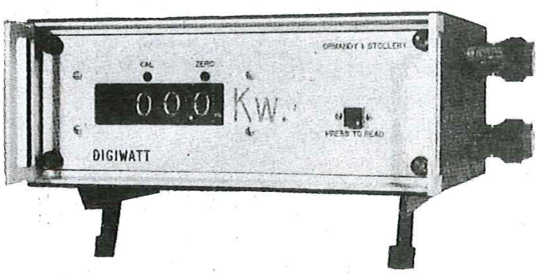


Illustration shows 'press to read' *option.*

RANGES. 10 watts 100 watts 1000 watts 10,000 watts 100 kw.

VOLTAGE 10V—500V OVERRANGE 100% in power at unity P.F. (1999)

CURRENT 1A—100A OVERLOAD 500% in power at unity P.F.

POWER FACTOR: 0.5—1.0 at full sacle or 0.25-1.0 at half scale.

ACCURACY AT 25°C 45 Hz-1 KHz ± ½% FULL SCALE ± 1 DIGIT
25 Hz-10 KHz ± 1% FULL SCALE ± 1 DIGIT

TEMPERATURE COEFFICIENT: ± 0.05% /° C.

OPTIONS AVAILABLE: PRESS TO READ, BCD OUTPUT, BIPOLAR INDICATION.

POWER REQUIREMENTS: 100 —125 V or 200 - 250 V 45 Hz—65 Hz 12 VA.

Dimensions 32 x 25 x 12.5 cms APPROX. WEIGHT 10 lbs (4½ kg)

DIGIWATT IS A REGISTERED TRADE MARK

ORMANDY & STOLLERY

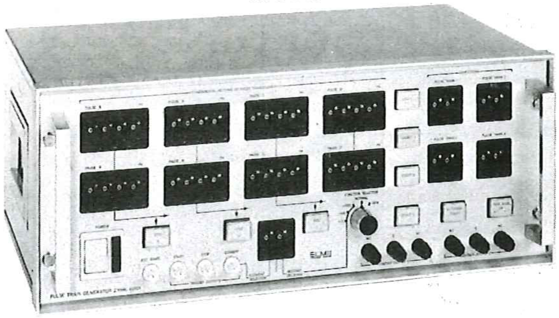
REGAL WORKS, STATION ROAD, BRIGHTLINGSEA, ESSEX

Telephone: 0206 30 2316/3636

ELMI

ELECTRONIC MEASURING INSTRUMENTS

mean



VERSATILITY in Pulse Train Generators in the testing of equipment for automatic telephone exchanges, telegraphy, business machines and similar apparatus.

UNEQUALLED PERFORMANCE in Time and Frequency Meters designed for time/frequency measurements of electromecnanical relays examining operate/release and bounce characteristics.

ACCURACY in Telephone charge analysers intended for checking the call data of telephone subscribers requiring verification of their telephone bills.

To **danbridge (u.k.) ltd.** Please send me an ELMI Short Form for further details of the above and other instruments in the ELMI range

NAME ____________________

POSITION ____________________

COMPANY ____________________

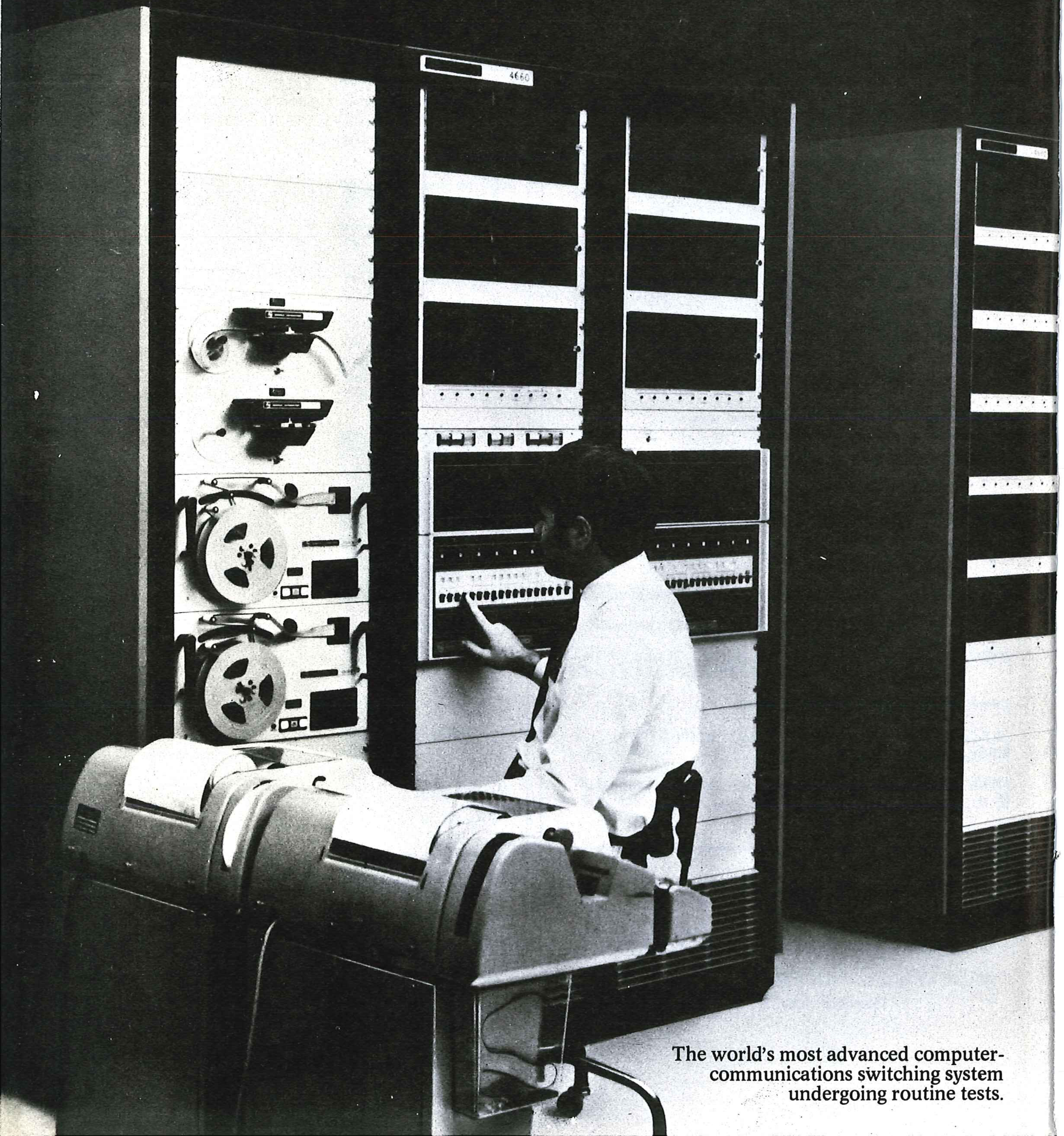
ADDRESS ____________________

____

danbridge (u.k.) ltd. SHERWOOD HOUSE, HIGH STREET, CROWTHORNE BERKS, RG11 7AT. Tel:CROWTHORNE 2369 (STD 034 46)

DANBRIDGE DENMARK

Today's telex exchange-SPC; electronic; solid state



The world's most advanced computer-communications switching system undergoing routine tests.

Plessey System 4660

Not so much an exchange as a computer that can take all the requirements of a telex network in its stride. There are no crosspoints in the conventional sense—the signal path is routed through the computer core memory.

Here are some of the things it can do: if an addressed line is busy it can hold the message until it is cleared; it can send a message to a required number of addresses in one operation; it can store messages until low tariff periods commence; it can select alternative/optional routes . . .

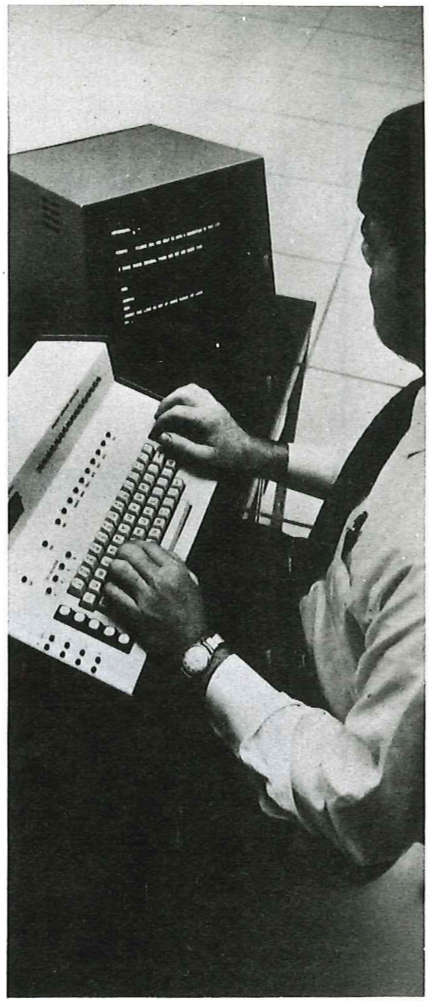
These are merely some of the sophisticated extras System 4660 can offer, but they indicate the advanced technology of its design. The terminal equipment, for example, includes operator consoles with c.r.t. display, print-out or magnetic cassette.

Sizes: systems can range up to 32,000 lines.

Features include: *High traffic capability · Modular design · CCITT compatibility · Economy and low cost · Speed and code conversion · Ease of maintenance · Automatic message accounting · Self diagnosis and fault indication · Space saving · Solid state reliability · Flexibility and speed of installation.*

There is a full spares and after sales service.

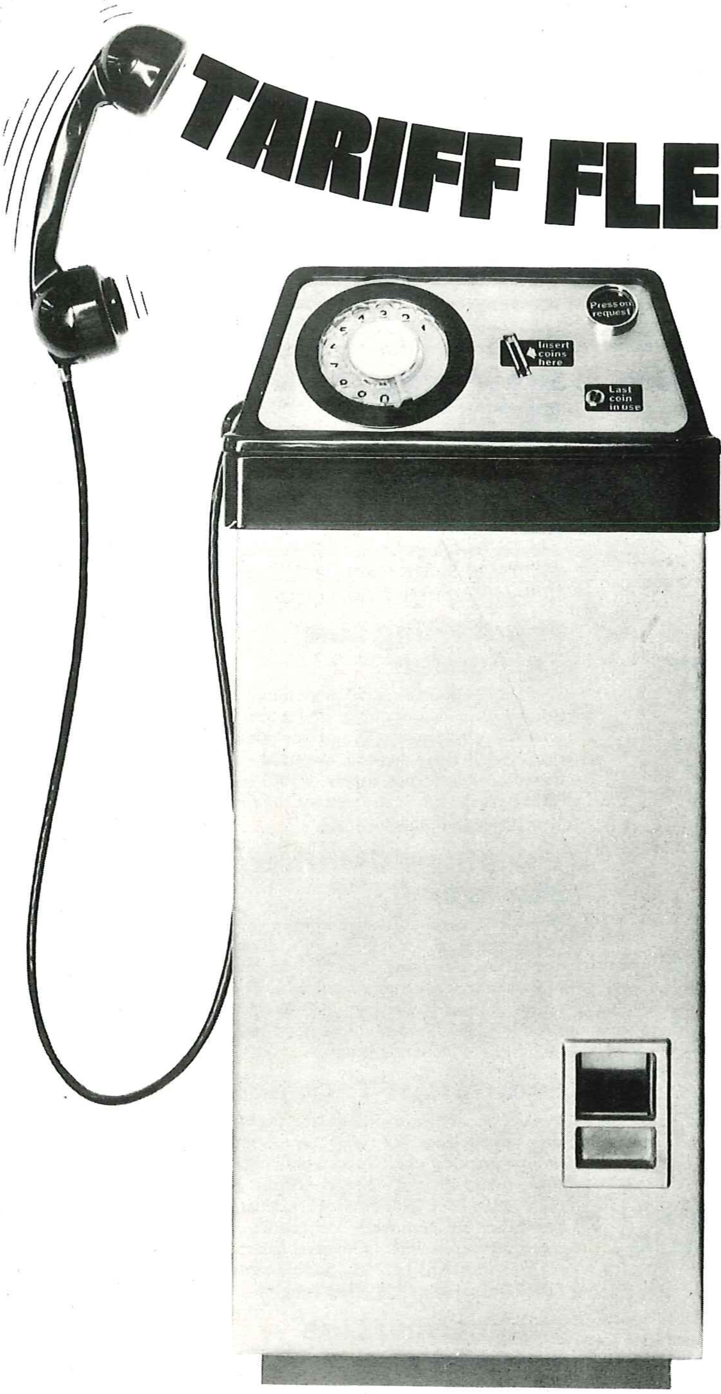
For further information about System 4660 please write or telephone: Plessey Telecommunications, Major Systems Marketing, Edge Lane, Liverpool, England L7 9NW. Telephone: Liverpool (051) 228 4830. Telex: 62267.



Cordless Switchboard Operator position handling assistance call with CRT Visual Display.

PLESSEY
TELECOMMUNICATIONS

TARIFF FLEXIBILITY



plus IMPREGNABILITY

This new 7000 Series Coin Operated Telephone allows changes in tariff rates by simply altering links in the electronic module.

The modern pleasing design hides a robust and rugged casing able to withstand the most determined attacks.

M.O.S.T. logic circuits monitor and control all functions within the call box.

Modular construction eliminates maintenance.

Associated Automation Limited

A member of the GEC group of companies

Dudden Hill Lane Willesden London England NW10 1DJ
Telephone 01-459 8070 Telegrams Astomation London Telex Number 935210

Telecommunications in Zambia

All the following posts are with the Ministry of Power, Transport and Works. Zambia offers year-round sunshine, attractive employment prospects, good salaries, tax-free 25% gratuities, lower income tax, free passages and baggage allowance, guaranteed accommodation – and an opportunity to use your qualifications and experience in challenging work in our newly developing nation.

Equipment Technicians

At least 4 years relevant experience including installation and maintenance of Strowger and crossbar type exchanges, automatic exchange and multiplex equipment, and subscribers' apparatus. Final C & G in Telecommunications or Intermediate if Technical Officer in the BPO, plus current driving licence. Salary: K2112 (£1390) to K3552 (£2340). Supplement: £750–£1032 (married), £438–£546 (single).

Assistant Telecommunications Engineer (Training)

At least 6 years executive experience in the British Post Office plus C & G or equivalent. Duties involve control of field training of learner equipment and learner line technicians. Salary: K3684 (£2430) to K4212 (£2780). Supplement: £1032–£1092 (married), £546–£612 (single).

Supervising Line Technician

A minimum of 10 years' experience, much relating to overhead open wire trunk routes, including surveys and material estimates, plus C & G and current driving licence. Responsibility for trunk route development works of all types will necessitate knowledge of appropriate regulations. Salary: K3072 (£2025) to K3553 (£2340). Supplement: £978–£1032 (married), £546 (single).

Assistant Telecommunications Engineer (Services H/Q)

C & G Telecommunications, Line Plant Practice 'B', 10 years' experience encompassing subscribers' apparatus, routes. Duties include investigation of service and engineering difficulties and recommending improved methods and procedures. Salary: K3684 (£2430) to K4212 (£2780). Supplement: £1032–£1092 (married), £564–£612 (single).

Supervising Line Technician

For cable route surveys, preparation of plans for stores and estimates, staff supervision, aiding maintenance fault clearance. 10 years' experience of the installation and maintenance of cables, and related works. A sound technical appreciation of DC testing procedures, plus current driving licence. Salary: K3072 (£2025) to K3552 (£2340). Supplement: £978–£1032 (married), £546 (single).

Assistant Telecommunications Engineer

To supervise international radio transmitting/receiving station. Intermediate C & G Telecommunications. Assistant Executive Engineer or Technical Officer, British Post Office. At least 7 years' experience. Salary: K3684 (£2430) to K4212 (£2780). Supplement: £1032–£1092 (married), £546–£612 (single).

Supervising Line Technician

To survey telephone applications, allocate cable pairs, compile/maintain records. At least 10 years' relevant experience with knowledge of underground/overhead distribution, and particular emphasis on records. Current driving licence necessary. Salary: K3072 (£2025) to K3553 (£2340). Supplement: £978–£1032 (married), £546 (single).

Supervising Line Technician

10 years' experience of installing, commissioning and maintaining all types of subscribers' equipment. Sound technical education and driving licence essential – C & G Certificate desirable. Salary: K3072 (£2025) to K3552 (£2340). Supplement: £750–£858 (married), £438–£486 (single).

Telephone Commercial Manager

Overall control of telecommunications accounts sales and certain traffic functions in one of two regions. Aged 35-55, at least 7 years' appropriate experience, 2 of them in senior capacity. Salary: K4140 (£2370) to K4500 (£2970). Supplement: £1032–£1092 (married), £546–£612 (single).

Equipment Technician

4 years' appropriate experience, plus maintenance experience of VHF and microwave radio systems or subscribers' telegraph equipment. If on Technical Officer grade in the British Post Office an Intermediate C & G certificate is required; otherwise, a Final certificate, plus driving licence. Salary: K2112 (£1390) to K3553 (£2340). Supplement: £750–£1032 (married), £438–£546 (single).

Supervising Line Technician

3 years' external experience, including overhead line construction and UG cable, plus Final Certificate or experience in subscribers' apparatus and test desk working. Duties include supervising subscriber installations. Salary: K3072 (£2025) to K3553 (£2340). Supplement: £978–£1032 (married), £546 (single).

Line Technicians

Experience should include maintenance, development, installation work for subscribers' apparatus or laying cable joining lead 7 PVC covered, or construction and maintenance of open wire routes. 4 years' relevant experience, 2 'A' C & G's in relevant subjects and current driving licence. Salary: K1872 (£1236) to K2952 (£1945). Supplement: £750–£858 (married) £438–£486 (single).

Workshop Mechanic

To manufacture a variety of items from drawings and specifications. 2 years' post-apprenticeship experience in either fitting/turning or sheet metal working, is required. Salary: K1872 (£1230) to K2952 (£1945). Supplement: £750–£858 (married), £438–£486 (single).

Equipment Technicians

At least 4 years' experience of either:

1. Crossbar and Strowger exchanges
2. Crossbar exchanges
3. Gentex/Telegraph Exchange equipment
4. Creed & Siemens teleprinters
5. Mixed load small station combining auto and carrier
6. Microwave relay stations
7. Multiplex carrier and VF telegraph systems.

Age 27 to 47. If currently on a lower grade than Technical Officer in the British Post Office, Final C & G necessary. Salary: K2112 (£1390) to K3552 (£2340). Supplement: £750–£1032 (married), £438–£546 (single).

Assistant Telecommunications Engineers

Experienced in either HF/VHF radio systems, trunk route schemes, telex exchange equipment or radio equipment installation. C & G Telecommunications plus 'B' year subjects and current driving licence required. Salaries: K3684 (£2430) to K4212 (£2780). Supplement: £1032–£1092 (married), £546–£612 (single).

Diesel Mechanic

A recognised apprenticeship, at least 10 years' experience including supervision and training of staff. To supervise the installation/maintenance of diesel engine plant. Salary: K3684 (£2430) to K4212 (£2780). Supplement: £1032–£1092 (married), £546–£612 (single).

Diesel Mechanic

With 2 years' practical experience and ability to maintain vehicles up to 5 tons plus static engines. Salary: K1872 (£1230) to K2952 (£1945). Supplement: £750–£858 (married), £438–£486 (single).

Technical Stores Officer

Substantial responsibility for all store activities, including staff control. Aged 35-54, with relevant executive experience – particularly telecommunications equipment and materials and a technical background. Salary: K2340 (£1540) to K3408 (£2245). Supplement: £798–£978 (married), £438–£546 (single).

Special note on supplements:
The British Government will pay tax free supplements (shown above) to British personnel appointed to any of these vacancies providing the appointed officer is designated for these benefits i.e. is a UK citizen or holds a UK passport, which also include an appointments grant, education allowances, free holiday visits for children educated in Britain, car loan and medical aid scheme. Full details will be sent on request.

ONE ZAMBIA ONE NATION

Please send full personal and professional details (without obligation) and indicating the position which interests you. Full details will be sent to you.
Recruiting Officer,
Zambia High Commission,
7-11 Cavendish Place,
London, W.1.

Post Office Telecommunications Journal is printed by Alabaster Passmore & Sons Ltd, London and Maidstone, and is published quarterly in January, April, July and October by the Post Office.